

C. M. & St. P. R'y. Co.

**Car Department
Handbook**



Class TF 600

Book C 37

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Chicago, Milwaukee & St. Paul Railway Company

TO PUGET SOUND—ELECTRIFIED

CAR DEPARTMENT HAND BOOK

Containing Procedure, Rules and Information Govern-
ing the Maintenance of Freight and Pas-
senger Train Cars, Locomotive
Tenders, Pilots and Cabs



(Superseding all Car Maintenance Regulations Previously Issued)

MILWAUKEE,
October 11th, 1922

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CAR DEPARTMENT

GENERAL ORGANIZATION

The Car Department exists for the purpose of constructing, repairing, and maintaining freight and passenger car equipment, locomotive tenders, pilots and cabs.

The Organization To enable it to fulfill that purpose facilities are provided, distributed over the railroad at points considered most advantageous as the result of study and experience.

These repair points are organized into Districts, in charge of District General Car Foremen, with the exception of the district West of Mobridge, known as Lines West, which is under the Assistant Master Car Builder. Districts are further split into areas under the control of General Car Foremen, according to the needs peculiar to each district. General Car Foremen are responsible to their District General Car Foreman, who in turn is responsible to the Master Car Builder, whose department is under the control of the General Superintendent of Motive Power.

Routine for correspondence and instructions All correspondence and instructions and orders will pass through the channels thus created, with the exception of those pertaining to routine matters or certain specially designated matters to be handled direct between individual points and the Master Car Builder's Office, or from individuals direct to persons authorized by the Master Car Builder to deal with them.

Necessity for complying with rules. The functions of the Car Department cover such a large field, and are given effect to over such an extensive area, that it becomes necessary in order to keep control and maintain satisfactory service, to follow certain fixed

rules, which are very clearly set out herein. These rules are laid down with the object of obtaining uniformity of procedure, resulting in co-ordinated effort, and are not meant to and do not deprive either separate points or individuals of initiative, which must be displayed at all times if success is to be obtained. At the same time, it is of paramount importance that the principles underlying these rules be adhered to. To carry out an undertaking in a different manner may appear just as satisfactory to the individual, but defeat a greater purpose not apparent locally. Employees in all capacities must therefore be impressed with the necessity for working according to practices herein defined, and those departing from them will be held responsible by the Master Car Builder for any failure obtaining as a result of non-adherence to the principles which have been evolved by experience as being generally applicable to the maintenance of equipment.

Clearness of meaning required. The preservation of an orderly and efficient department can only be maintained by those having to carry out a planned operation obtaining a clear grasp of what is required. It is therefore necessary in receiving and passing along instructions that definiteness and clearness be preserved, and

that requirements of other departments be received through the Master Car Builder's office only.

*Separation
between rules
governing Oper-
ations and
Administration.*

To make clear what is required, these rules have been divided into two groups—those pertaining to actual operations, and those governing the rendition of reports and keeping of records.

*No alteration
other than by
specific cir-
cular.*

No alteration or addition to these rules will be made excepting by circular letters headed "*Organization*," and marked "*Operations*" or "*Administration*," as the case may be, which will first quote the section and rule to be changed. Extracts from these circulars will be printed periodically so they can be readily embodied in this book.

*Relation of
other Circulars*

(Other circulars issued will not be so headed. They will give instructions covering any work to be done, convey information, invite attention to any situation such as non-compliance with the Rules contained in this book, or make any necessary explanation.

M. E. Circulars will enlarge upon and explain technical requirements in connection with the construction of and repairs to equipment; Safety Appliance Bulletins will make clear detailed requirements; M. C. B. Bulletins will explain M. C. B. rules.)

Section I—INSPECTION.

Para. 1. GENERAL RULES GOVERNING INSPECTION

The railroad is largely dependent upon its inspectors for the successful handling of its trains. They must be fully acquainted with what is required in connection with equipment, and be prepared at all times to take steps to see these requirements are complied with.

It is of the greatest importance that inspectors adhere to the regulations laid down for their guidance, and not allow themselves to be over-ruled by trainmen or others against their own good judgment. The safety of passengers and crew, as well as of equipment, demands the protection of their inspection, and this must not be set aside. Occasions will arise, however, when a superintendent or other officer of the operating department will find it necessary to over-rule the judgment of an inspector, in which case the latter must protect himself by asking for instructions in writing.

This does not mean that inspectors working in transportation yards or depots are to refuse any legitimate request emanating from the operating department, with which the very closest co-operation must be maintained at all times, but it does mean that inspectors must not allow either individuals or circumstances to defeat the very purpose they are there for.

Inspectors must be fully cognizant of safety appliances, wheel and axle requirements, and must be able to pass the regular monthly examinations instituted as part of the policy of this Company in the education of employes in their duties.

The following kinks for inspectors are published for information:—

Nuts missing from column bolts and journal box bolts indicates there is a flat wheel on the truck. A car which leans badly also denotes that something is wrong with the truck, such as a missing side bearing, broken truck frame or broken truck springs. If these are in good condition, the leaning of the car may be the result of too much load on one side.

If the end of a journal is dry in the center, it is a sure sign the journal is getting insufficient lubrication, and will probably be found cut on this account, although the journal may be only slightly heated. If a car is found riding hard on the side bearings, the inspector is induced to look for a broken bolster or broken center plates. When the head of a coupler is down the inspector examines the center sills at the bolster and the yoke or yoke rivets. When the coupler head sticks up and is out of the straight line of draft, the draft sills may be broken and have come down at the bolster, or the draft gear may be down and throwing the coupler out of level; when the coupler is too low the inspector looks to see if the car is off at the center before measuring the height of the coupler above the rails. If the floor is humped up over the center pin he knows the center sills or body bolster are broken or bent.

Broken bolts can often be located by picking off the top piece with the fingers when the bolt shows no signs of being broken, except slight signs of the top having moved. Hot wheels cause the car inspector to test out the air brakes and look for a short piston travel or a sticky triple, and to see if the hand brake is set. He also examines the plates and brackets to see if any are cracked. A

blue color tread indicates that wheel has been overheated, even though it is cool when he finds it.

Grain laying around on top of the body bolster or spring plank indicates that the car is leaking. The pounding of the siding along the side and end sills, or pounding on the bottom of the decking will start the grain leaking.

A wheel which does not line up on the rail the same as the other wheels causes the inspector to look for a loose wheel or a bent axle. A bent axle can sometimes be discovered by the uneven rail mark on the tread of the wheel which will not run true to the flange, but will be nearer on one-half of the wheel than on the other half. A wheel squeaking every time it makes a revolution, indicates a bent axle. The journal box will move up and down, and the wheel will wobble if the axle is bent or the wheel is bored out of true. When the outside edge of the rim of a wheel is scraped it denotes a loose wheel or one that has been running along inside of the rail. A continued squeal on a car is the result of a rough journal. A grinding screeching noise is caused by a car riding hard on the side bearings, which prevents the truck from lining up with the track. A sharp snapping noise like an electric spark, indicates that a wheel is sliding on the rail.

A sound of a brake beam being shaken violently is evidence of the car brake sticking or the hand brake being set when the car is in a train pulling out of the yard. A cloud of dust under a moving car is usually found to be caused by a brake beam coming down. A car badly sagged in the center is the result of truss rods being out of place, broken or loose, and that the load has shifted to the center of car. A center pin resting on the spring plank indicates the pin is broken. A broken knuckle pin can be detected by feeling the bottom of pin, or where the pin is supposed to be, if not broken.

When inspecting a train it is a good plan to lift up all knuckle locks slightly with the uncoupling lever, to ascertain if the chain or lock is broken. All suspicious looking grab irons and ladder irons, should be given a pull to ascertain if they are loose enough to be dangerous.

A car roof that gives under a person walking over it is apt to have broken car lines, or car lines out of place. Flour, or cement sticking to the side of a car indicates that sacks inside of car are torn.

If sharp curve of lock shift on Sharon coupler is towards car, it is a defect. This lock shift is designed to prevent draw-bar coming down on rail, but its purpose is defeated if wrongly applied as described.

In examining air hose in transportation yards, or other places where air pressure *is not available*, many defective hose can be found by inspectors grasping hose close to nipple, twisting slightly, and noticing whether loose on the nipple.

Operating Rule 26 is quoted for information, and must be strictly adhered to. Any infringement by a Car Department employee will result in dismissal. Infringements by employes of other departments must be reported through the proper channels to the Master Car Builder.

Rule 26 "A blue signal, displayed at one end or both ends of an engine, car or train, indicates that workmen are under or about it: when thus protected is must not be coupled to or moved. Workmen will display the blue signals and the same workmen are alone authorized to remove them. Other cars must not be placed on the same track so as to intercept the view of the blue signals, without first notifying the workmen."

Para. 2.

SELECTION OF FREIGHT CARS

Sub-Para. (I)

GENERAL REQUIREMENTS

In any successful movement of traffic, it is of prime necessity to first see that cars going to industries, loading stations or loading territories beyond the reach of local car repair points, are gone over and put in suitable condition to run to whatever destination they may be scheduled to reach; also that they are in fit shape to carry the lading which they are intended to carry, so as to avoid delay in movement, damage claims, or the necessity of transferring the load en route. In this sense, large terminal loading tracks should be piped with air and have suitable repair materials and facilities conveniently placed. In the past entirely too little attention has been given equipment at loading platforms at large industries when it has been a matter of daily experience to have cars brought right over at the close of the day and placed in our most important time freight trains, without enough time being allowed to do the necessary work on the equipment; the latter being true since no effort had been made to put the cars in shape while they stood idle during the day. The result is obvious, and with the matter brought out so clearly and being one of daily observation, we must make the necessary effort locally at every station on the system and correct this.

A box car to handle grain, flour, sugar, or groceries, should be in the best condition possible. The siding must be tight, the roof non-leaking, and the floor and lining level and smooth, so as not to chafe or injure the contents. Wool, raw cotton, hay, brick, etc., may be handled in a car in fair condition without damage. A leaky roof or open siding will not injure these articles, and they cannot fall through cracks in the floor as would bulk grain. The only essential for cars handling the last mentioned articles is that the frame work of the car be strong enough to hold the load and that the trucks and draft gear be in good condition.

A refrigerator car must always be in good condition in order to protect its lading, due to the fact that the requirements of this service are very rigid. A stock car should be in good condition in order to handle live stock without damage, but the same car in fair condition will haul barrel goods, rough lumber, ties, lump coal, and many other articles, very satisfactorily. A gondola must be in very good condition to hold slack coal without loss, but will hold lump coal, coke, scrap iron, etc., if in only fair condition. Trouble is experienced when we get out into the western coal district. If any old car is used for this coal lading, the car and contents are both liable to be burned up. A fairly good car must be used on account of the fire risk.

There are a good many commodities that should never be loaded in a first class car, and this is one of the worst abuses we have to guard against—the use of good cars for loading such commodities in them as hides, fertilizers, immigrant outfits, scrap iron, coal, pitch, oil, refuse from sugar factories, tar and things of that kind. This matter must receive close attention. If we have around 75 per cent, or about three quarters of the box cars in first class condition, we ought to be able to take care of our business

in good shape. By "First Class" condition is meant a car that is good enough to handle grain or similar products, but these cars must be properly distributed.

In using commodity cards or boards to designate what loading a car is suited for, close supervision is necessary. After a car has been unloaded these cards or boards must be removed, otherwise numerous claims will result account of cars being used again without further inspection.—All inspectors should have this point clearly explained to them.—Similarly, explosives signs should be removed as soon as cars are emptied.

In order to define the requirement of cars for various commodity loading, the following will govern.—

Sub-Para. (II)

GRAIN CARS

A suitable car for bulk grain loading is one that has the decking, lining, sheathing, posts and grain strips and roof in a good tight condition, or in other words, *will not leak grain*, or a car which can be made fit by the shipper at the time and place of loading by ordinary and proper care in use of coopering material and by a reasonable amount of cleaning. A car with door posts shattered or broken or loose from the framing, or with other defects of such character as to render the car obviously unfit, or with the inside showing the presence of oil, creosote, fertilizer, manure, or other damaging substance of like or kindred character, should not be used for grain. Where a shortage of suitable cars obtains, it is often desirable and necessary to fit cars up specially and under these circumstances, where the body of the equipment can be made fit and suitable in twenty car men hours or less, it should be done. This work is usually carried out under extreme pressure and may consist of employing anchor bolts to secure down posts, slabbing the sheathing at both the end and sides to sills, reinforcing broken posts with old iron, such as levers, threshold plates, iron straps and applying a supplementary end lining over the old or defective structure, including false bulkheads in body of cars, jacking bulged out ends in place, and applying straps, anchor rods or bars, slabbing side or end plates, slabbing belt rails, patching sheathing, roofing and floors with old metal roofing. Under all circumstances, the running gear, brakes, wheels, lubrication and safety appliances must be in as nearly 100 per cent condition as possible. All of the above is exclusive of applying grain doors as these are installed by the shipper. In delivering empty cars suitable for grain loading to our connections, it shall be the understanding that the cars which cannot be made fit with an expenditure of ten (10) car man hours shall be returned, the same to be true as a basis of acceptance between connecting lines giving us cars for such loading, and ourselves. In further explanation, box cars which are fit, or such as have light running defects, will be accepted or offered on an equal basis. In order that there may be a universal understanding as to what is meant by the term "Light Running Repairs" it will be understood that same covers cars having such defects as missing plain wooden side doors (this not to include "Wagner" or other special all metal or steel bound side doors), broken draft timber or strap bolts, slight defects

to wooden or metal roofs, to side or end sheathing and lining or other light running repairs, such as can be made by the receiving line or yard repair tracks within the time allowance prescribed, or such as can be coopered by the loader to make the body fit for the lading intended.

While grain cars should at all times be in first class shape, during periods of stress cars will be coopered and loaded that would not, normally, be used for loading grain at all. During such times it must be remembered that on Lines West only first class cars can be used, on account of the long hauls and operating conditions. Nothing but long draft arm cars are to be sent west for this loading, and then at least 80%—if possible 100% must be steel underframe cars. 60 M cars will only be sent under exceptional circumstances. In operating trains in certain territory the first 15 or 20 cars behind engine must have metal roofs, on account of the risk of fire, and in selecting cars for grain loading on Lines West this must be taken into consideration also.

Sub-Para. (III)

FLOUR CARS

In going over cars for flour loading, the main points to be considered are a good tight roof and sides, good close fitting doors, a good clean floor and freedom from the presence of oil, creosote, fertilizers, manure or acid spots which are liable to contaminate the lading. Roofs to be given water test where possible. A car that has been loaded with hides should not be used for flour, or any other car that has been loaded with commodities which has left a bad odor. During the winter months, cars equipped with all metal roofs or ends, uninsulated, should not be selected for flour loading unless it is distinctly understood that the doors will be left open at least four hours after being loaded, as when hot flour is put into a cold car that has an all metal roof or end exposed in the interior, it causes the metal to sweat and moisture dropping down on the sacks injures the flour, and the millers object to loading these cars on that account, however, if the doors remain open for a short period it tends to equalize the temperature. It has developed that where flour is loaded in a warm condition in any kind of car, whether all steel or all wood, if the temperature of the weather is very low, there will be condensation of moisture due to the fact that there is no ventilation in the car, and consequently, it will cause sweating. In the interest of claim prevention, we should endeavor to prevail upon the flour mill people not to load their flour into cars during extremely cold weather, but if they do so load it, then the flour should be covered with paper in order to protect same against the drippings from the sides, ends or roofs of the cars. Moisture on the floor or any part of the interior of car must be avoided. Cars to be used for flour loading should also have all nails or protrudances either removed or drawn in and anything that is liable to injure sacks in transit either removed or covered over by the parties making the shipment before it is loaded. It is often difficult to obtain a sufficient number of cars, in which case cars are sent from one territory to another on the system, or perhaps it is arranged to obtain relief from connecting lines, and at other times we have to give assistance to our neighbor roads. In order to avoid any dispute either from the standpoint of offering cars

to connections or accepting them, it shall be understood that the equipment will meet the above requirements and under no circumstances must we offer or accept cars where it is necessary to spend more than five (5) car man hours to make the body fit, and regardless of this, cars are at all times to be in proper shape, so far as concerns the trucks, draft gear, journal boxes, and the contained parts, brake equipment and foundation gear and safety appliances.

The following rules for inspection of flour cars, arrived at after a conference with shippers, are laid down for guidance.

Rule 1. (a) The first duty of the inspector is to enter the car at all times, close the doors, both sides and ends, remain in the car sufficient length of time to be fully convinced that no openings may be seen through roofs, sides or ends, and then open the doors and observe closely if there are any stains of previous loading, with such as oil, creosotes, fertilizer, manure, and spots, hides, bones or numerous other contaminating commodities that would prohibit the loading of car with flour. If any such indications are present and they cannot be entirely eliminated, a question of doubt must be given to the flour loading, and car condemned as unfit for such commodity.

(b) The same inspection of the interior of the car as mentioned in paragraph (a) must be closely observed on the floor, sides and ends, for protruding nails, bolts, or other projections that would in any manner damage the bags or sacks being placed in the cars. This also to include proper lining which should be sufficient to protect the lading.

(c) The general condition of the floor need not necessarily be tight, but it should be fully understood that any boards nailed over the floor or floor boards must be such as not to have sharp corners or edges which will damage the flour bags; bearing in mind also that no pieces of tin should be applied to flooring or lining, as damage to the lading will surely follow.

Rule 2. (a) An exterior inspection of the roof must be made to show that it is water tight. Special attention should be given to all types of outside metal roofs for cracks, nail holes, corrosions and shifting tins.

(b) While the foregoing has practically covered the entire superstructure of the car, great care must be exercised to see that the posts and braces and sheathing are tight and in place.

(c) The running gear and draft gear to be in serviceable condition.

(d) All inspection of equipment for flour loading must positively be made in daylight only.

Sub-Para. (IV)

SUGAR CARS

Equipment intended for sugar loading must have first class roofs (same to be subjected to water test if possible). Siding must be weather proof and doors close fitting. Interior of cars, especially the floors, should be clean and dry, also free from all substances which might soil the sack. Bolts, nails and other items which are liable to tear the sacks should be removed or flattened down. Side door protection must be provided by shipper to avoid sacks being out from the outside through bottom doorway opening.

Sub-Para. (V)

MERCHANDISE CARS

Equipment for merchandise should have the body in fair condition. Cars of light superstructure should be selected in preference, especially ventilated

box cars of southern ownership and when refrigerator or produce cars are not in extreme demand, they can also be placed in this service. Particular attention should be given to the condition of the side doors so as to insure the lading against the elements and especially to avoid sparks setting fire to the contents of the car. All brackets, hangers, fastenings and other fixtures should be in good working order to avoid the possibility of side doors swinging out or be forced away from the side of the car without breaking the seal. Roofs to be given water test where possible. A knowledge should be had in regard to the territory where cars are to pass, so as to make certain of their going to destination successfully, besides having a reasonable certainty of their being able to carry a revenue load back from the territory into which they are going. In explaining this it is well to state that cars for movement west of Mobridge, or east of Seattle, must be equipped with wooden or metal draft arms, extending at least thirty (30) inches behind the center of the body bolster, having through steel center sills, or metal underframes, as we cannot successfully operate equipment of less strength in our large tonnage trains passing over the five ranges of mountains which must be traversed in a system movement between Harlowton and Seattle. Furthermore, our chief loadings at intermediate points between the Twin Cities, LaCrosse, Milwaukee, Savanna and Council Bluffs, Sioux City, Mitchell and Cle Elum are grain products, and finished lumber between Deer Lodge and the Coast. It is, therefore, evident that such equipment as is employed in the ventilated fruit and vegetable service of roads like the Seaboard Air Line, Southern, Florida East Coast, Atlantic Coast Line, Southern, Louisville & Nashville, Illinois Central, Central of Georgia, etc., is not designed for carrying grain products or shifting loads of lumber, and is consequently an embarrassment to our service when loaded out into the territory mentioned. The large type of so-called "Furniture, Carriage and Machinery Cars," usually of extreme length and height, when of wooden underframe construction should never be allowed to pass excepting between our large cities, and only those cars of this type which have steel underframes should be employed for movement west of Aberdeen. Long cars of this type are weak in the center and where a pusher or helper engine is used it causes them to sag in the center, allowing the couplers to raise at the ends with resultant break in twos; besides, when loaded to the roof with lumber, they are top heavy and subject to derailment on curved track or mountain grades. In order that this matter may be controlled, such cars arriving at Mobridge in violation to the above will be marked out and transferred, such expense being charged to Transportation Account (373). Further, it is well to bear in mind the homeward movement of refrigerator cars, and avoid as much as possible dead haulage. Any commodity of a clean nature or such as will not leave an odor, can be loaded in refrigerator cars. For instance, sugar, coffee, boxes, cans, glassware, kitchenware, merchandise in boxes and barrels. It should be observed whether refrigerator cars have collapsible bulkheads, and in case they do, these ought to be raised when loading merchandise, in order to utilize all available space for revenue purposes. Ice hatches should be carefully sealed and ice plugs put in place.

**Sub-Para. (VI) AUTOMOBILE, FURNITURE &
CARRIAGE CARS**

Cars for automobile, furniture, carriage, curio, can, crockery, tire and rubber goods loading falls under the same requirements as merchandise and manufactured goods. However, all selection is made for equipment of large cubical capacity and wide side and end door openings.

All concerned should bear in mind the necessity of loading only steel underframe, steel framed or all metal cars to points west of Aberdeen, or east of Seattle. End doors should be fitted with safety chains to keep doors from swinging out and fouling passing trains. Some of the so-called automobile cars with wide door openings have a portable door post fitting at center of opening of doorway, others are fastened to the door and some are not. Care should be exercised to see that these posts are properly in place on cars, provided they are in any way visible when doors are closed, under which circumstances they are cardable in interchange if missing; if they are not visible and there is no way of ascertaining their presence when doors are closed they are not cardable.

Sub-Para. (VII) REFRIGERATOR CARS

Very heavy losses may result to the Railroad if refrigerator cars are not in proper condition when loading. A considerable number of these cars have to be utilized from time to time for grain loading, for which purpose bulkheads are provided by boarding up the space at the bottom of the ice box bulkhead, and in some cases the upper ventilating space is also boarded up. Close attention is therefore necessary to see the temporary bulkheads are removed, and the refrigerating and ventilating features of the car are in good shape, before the car is loaded with perishable freight. When ice is to be used in a refrigerator car that has been used temporarily for grain loading, the car must first be opened up and properly aired, in order to protect its perishable load against contamination.

Some of our heaviest losses can be traced directly to carelessness in inspecting refrigerator cars and not seeing that they are thoroughly cleaned. The following is therefore laid down for strict observance:—

The only way to properly clean the drain pipes and drip pans is for a man to get inside the ice bunker, take up the ice gates, remove all accumulations of shavings, saw-dust and cinders, see that the drain well caps are in place, and that the drain pipes are open. Many of the refrigerator cars which have been in winter service have the ends covered with paper in order to avoid heating up that portion of the space in car occupied by the ice bunkers. This paper or other covering should be entirely removed at the time that the drip pans and drain pipes are freed from refuse material.

**Sub-Para. (VIII) HAY, STRAW, WOODENWARE,
CONCENTRATE LIME AND CEMENT CARS**

Cars intended for hay, straw, woodenware, concentrate, lime and cement loading should have roofs in first class condition (same to be subject to water

test if possible), siding should also be weather-proof to avoid moisture (rain or snow) entering car. Side doors should so fit as to exclude the elements. Side door protection to be provided by the shipper. Nails and bolts which are liable to cut the sacks should be removed or flattened down.

Sub-Para. (IX)

COAL CARS

Cars for coal loading need trucks, wheels, hand brakes and air brakes in good condition, and to be free from safety appliance defects. Side stakes must be in good condition to prevent sides bulging. Before going to mines it must be seen that cars are thoroughly cleaned out, and that dump doors are properly locked and safe to carry load to destination.

In selecting a car to replace loaded car—that is, to have a load of commercial coal transferred to it—the same class of equipment must be selected. If load is contained in a flat bottom car, it should be transferred to a flat bottom, and if from a hopper, to a hopper, etc. Many claims have resulted from failure to observe this rule, and much loss has been occasioned at times on account of allowing cars not in proper shape to be loaded, resulting in repairs having to be made under load, or load transferred. Often coal is ordered of a certain size, and in the process of transferring is broken down with the result that it is refused at destination. Losses also result from handbrakes not being in perfect condition.—Cars are generally operated down inclines at mines, and any failure of the brake is liable to cause damage to the car. These points should be carefully watched by inspectors handling coal equipment.

A certain number of coal cars are used for the shipment of screenings. Such cars must have tight floors, sides and dump doors, and be free from cracks and small holes that would have no bearing on the use of the same cars for carrying ordinary lump coal.

Sub-Para. (X)

POWDER OR EXPLOSIVES, CARS

Cars required for the conveyance of powder or explosives must be most carefully selected. Box cars are required of not less than 60 M capacity, steel underframe with friction draft gear. Air brakes and hand brakes must be in good condition.

The body of the car must have no loose boards or cracks in the roof, sides or ends through which sparks may enter. The doors must shut so closely that no sparks can get in at the joints, and when necessary, they must be stripped. The stripping for doors must be on the inside and be fastened to the door frame where it will form a shoulder against which the closed door is pressed by means of wedges or cleats in door shoes or keepers. The openings under the doors should be similarly closed and hasp fastenings must be examined with doors closed and fastened, and the doors must be cleated when necessary to prevent door shifting. If the door is opened for any cause during transit, wedges or cleats must be replaced before car containing explosives is permitted to proceed.

The journal boxes and trucks must be carefully examined and put in such condition as to reduce to a minimum the danger of hot boxes or other failure necessitating the setting out of the car before reaching destination. The lids or cover of journal boxes must be in place.

Holes in the floors or lining must be repaired and special care taken to have no projecting nails or bolts or exposed pieces of metal which may work loose or produce holes in packages of explosives during transit.

When packages of explosives are to be loaded over exposed draft bolts or kingbolts, these bolts must have short pieces of solid, sound wood with beveled ends (2-inch plank) spiked to the floor over them (or empty packages of the same character may be used for this purpose) to prevent possibility of their wearing into the packages of explosives.

The roof of the car must be carefully inspected from the outside for decayed spots or broken boards, especially under or near the running boards, and such spots must be covered or repaired to prevent their holding fire from sparks. A car with a roof generally decayed, even if tight, must not be used.

Before a car of this class is permitted to be loaded, a "Car certificate" signed in triplicate must be made out either by the car inspector or agent, and a copy attached to the outside of each car door, the lower edge of the certificate not less than 4-1/2 feet above the floor level. The original copy must be filed in the office of the agent or superintendent. (See Para. 1665 of ICC Regulations for the Transportation of Explosives.)

Sub-Para. (XI)

STOCK CARS

Stock cars need to be in condition that will guard against any possibility of delay or derailment, as heavy losses result from these causes. In shipping hogs proper regard for showering must be given when selecting car. If horses or cattle are to be shipped the car must be examined for protruding nails, screws or bolts likely to cause injury. A car is often used by a number of shippers, temporary partitions being put in to separate the stock. When these partitions are removed protruding nails remain, and these must be removed before car is again loaded.—Inspectors at loading points must actually get into the car to make the necessary inspection, otherwise claims will continue.

Some stock cars are in service which were formerly equipped with water troughs, but the troughs have since been removed. These cars should be carefully inspected to see that none of the piping remains, or any of the fastenings which hold or held the piping are left, as they will almost certainly cause injury to horses if shipped while cars are in this condition.

Double-deck stock cars must have the upper decks properly supported, either by temporary or permanent supports.

**Sub-Para. (XII) STORE DEPARTMENT & COMPANY
MATERIAL CARS**

It is very important that cars loaded from principal store houses on the system to supply various stations, should be in perfect condition, so as to get materials to destination without delay. Also that when cars are empty, they will be fit to carry a load of grain or lumber in the opposite direction. In like manner, scrap materials sent in to main terminals or principal stations should be loaded in defective equipment which cannot carry a revenue load through the territory to be traversed. For instance, it is intended that the Milwaukee storehouse will forward materials destined for Aberdeen or Miles City in a grain car, so that this car can be put into service and return with a revenue load eastbound. In selecting a car for the shipment of scrap from Aberdeen or Miles City to Milwaukee there are always plenty of unfit foreign cars which we are anxious to get rid of to owners at gateway points, and these should be used in such instances. A very great saving can be made in this way and avoidance of backhauling empty defective cars. Worn out Rock Island, Burlington, or Pennsylvania cars at Miles City can be loaded to Milwaukee with scrap and it is not difficult for us to get rid of them at Chicago. The same is true of Soo Line cars at the Twin Cities, or Northern Pacific and Great Northern cars at Tacoma or Spokane. (Short draft timber cars are not to be loaded west of Aberdeen, otherwise shipment will be transferred.)

Sub-Para. (XIII) ROUGH FREIGHT CARS

Cars which are in more or less poor condition, so far as the superstructure is concerned, may be used for rough freight such as coal, brick, hides, oil in barrels, castings, wheels, steel forgings, etc. Care must be taken to see that wheels, draft gear, safety appliances and other parts necessary to safe running of car are put in good shape.

**Para. 3. INSPECTION OF FREIGHT CARS BEFORE OR AFTER
BEING PLACED FOR LOADING**

We have many points on the system, especially at large terminals, such as the Deering Plant of the International Harvester Co. at Chicago, Montgomery, Ward & Co., Chicago; Solvay Coke Plant at Milwaukee; the Washburn Crosby Co. at Minneapolis; Packing Plants at Sioux City, Omaha, St. Paul, Spokane; Cereal Mills at Cedar Rapids, etc., where high class competitive freight is loaded and received. Cars are made empty and unless carefully watched are apt to be reloaded out on our line in defective condition, due to faulty running gear, improper body construction for changed commodity loading, etc., opening an avenue to damage claims and excessive delay en route.

Inspectors who do their whole duties at points like these are assets to the organization, as they are generally away from any immediate supervision, and their opportunity for service is great. They can assist the railroad in its handling of traffic by seeing that only proper cars for any

specified loading are allowed to be considered for outbound movement over the railroad, and where improper methods are followed in the use or delivery of cars, either loaded or empty, that instant report is made so that proper precaution can be taken and remedy applied, besides seeing to it that all necessary light or running repairs are faithfully carried out. Irregularities coming to notice day by day, should never be dropped until someone has seen to it that lax methods are avoided and stopped. In order to make such a plan effective, it is well for car inspectors to commence the day by going over all cars in their jurisdiction to note especially those fit for loading, marking out any which cannot satisfactorily be loaded, assigning the various grades of equipment to meet requirements, having in mind the territory on the system where they are to be made empty, and using good judgment in assuming that they must make a round trip at least so far as their physical condition is concerned, and also that they will be fit to carry a full return load of such commodities as originate in the territory from which they are to return. It is also well to remember when desirable to get cars to home connections, full knowledge of prevailing loading and the direction of same is necessary, so that proper movement may result.

As a rule cars such as referred to above will be inspected before being placed at elevators, manufacturing plants, etc. and are to be given a No. 1 Inspection.

System Cars with journal boxes repacked over 12 months previously are to be marked to repair tracks, where the cars will be jacked up, brasses removed, all necessary attention given contained parts, boxes repacked, and car stencilled accordingly.

When cars are being inspected prior to going into trains 65 or more cars in length, short draft timber cars should be marked, and switched to rear of train. Difficulty in getting trains made up in this way will be experienced at some points, but constant pressure is to be maintained until it is done, as the damage to equipment and freight resulting from hauling weak cars in the head end of long trains is so great as to more than offset any cost or loss of time in switching during the making up of trains.

Para. 4. INSPECTION OF FREIGHT CARS IN TRAINS

Sub-Para. (1) GENERAL PROCEDURE

When a train is made up it must be inspected before being allowed to depart, regardless of what inspection has been given the cars prior to switching into train.

As soon as a train arrives at a terminal or inspection point, it must be inspected and not allowed to stand long enough for hot boxes to cool before it is gone over. The exact method by which this inspection will be made will depend upon the number of men available to go over the train, but examination of cars must be made from both sides, and not merely from one side of train.

There are three classes of inspection—No. 1 (Terminal), No. 2 (Divisional Repair Points), and No. 3 (Intermediate Inspection Points). No. 1 Inspection consists of a thorough examination of each car, and test of air brakes, and is to be given cars on repair tracks. No. 2 Inspection consists of a thorough examination of cars in accordance with information given herein for each physical part of the car, and will be given all freight trains arriving at, departing from, or passing through Divisional Repair Points. No. 3 Inspection is comprised of examination of brake rigging, attention to hot boxes, and running air brake test, and will be given trains at Intermediate Inspection Points, where, usually only one or two inspectors are employed. The carman giving a train a No. 3 Inspection is expected to eliminate any trouble in connection with brake rigging, hot boxes, or air brakes, but he must be watchful at all times for other defects, and should ever be alert that truckside failures or bad wheels which it is possible to observe during a hurried inspection, may not escape his notice. In addition to Safety appliance, wheel, axle, and brake requirements specified in paragraphs 8, 9, 10 and 11, the following should be observed:—

Sub-Para. (II)

JOURNALS

Journals must be inspected by raising lids and feeling the end of the journal with the hand. Ordinary running temperature is found to be roughly 120 deg. to 130 deg. Fahr. A new journal will usually run to 180 deg. Fahr. before wearing down to a full bearing. This is caused by contact between the brass and journal being only part of the full bearing, and the weight of the load is therefore confined to the contact area, increasing friction proportionately. The temperature is raised as a result until the brass wears down and the area of contact is increased. Great care should be exercised in handling such “warm” journals, and all that is usually necessary is to stir up the packing and add a little oil. If the journal is smoking and appears to be too hot to be allowed to go without attention, the brass should be removed and examined. If bright spots are found on the brass they should be filed down, or if it appears all right, *the same brass must be put back.*

When jacking up a journal for examination the waste must first be moved, placing it on a bucket or in some manner preventing it from touching the ground or becoming dirty. This does not mean it is merely desirable to keep packing clean—it is absolutely necessary, and failure to follow the instructions will be dealt with as a serious matter. When replacing use packing prepared in accordance with instructions laid down in Section 4, Para 4, and place in box as also outlined therein.

In ordinary cases of hot boxes, ice positively must not be placed inside the journal box after rebrassing and packing. In bad cases, where the journal has become heated until it shows red, packing (if not burned up) and brass should be removed, and journal allowed to cool in the ordinary way. *Water or ice applied while journal is red, or until the heat causing redness not only on the outside but on the inside has gone, will ruin the axle entirely.* If applied while red the journal may snap right off, but

crystallization will undoubtedly occur, which means the usefulness of the axle is gone, and if allowed to remain in service will sooner or later cause a wreck. If water or ice is applied as soon as the exterior redness disappears, and while the interior is red although it cannot be seen, the sudden shrinkage when cooled quickly causes the outside black surface to squeeze the inside red metal, resulting in what is known as "piping." A journal in this condition will surely cause a wreck if allowed to remain in service. Both inspectors and trainmen must therefore be warned that a red journal must be allowed to cool naturally, *and water or ice not applied until at least ten minutes after redness has disappeared. Trains—without exception—are to be held accordingly when necessary, in the interests of safety.* When journal has cooled to the point mentioned, ice and water may be used to further reduce its temperature, and the journal box then wiped out, brass applied, box repacked, and car allowed to proceed, but no ice is to be placed inside of box at this stage.

When a brass is removed on account of a hot box, the inspector will feel with a pulling hook to ascertain whether the journal is cut or not. This can better be done by using a journal feeler, which transportation yard and depot inspectors should provide themselves with.

Journal box lids should fit well in place and be properly secured to exclude dirt and dust.

Sub-Para. (III)

DRAFT GEAR

Inspection must be made to see that all parts of draft gear are in good condition, and head end cars in especially good condition, so that no failure will result on the road. Carrier irons and straps should be secure and in place. Yoke rivets should be sound and tight, draw lugs substantially in place and draw gear carriers properly fastened.

Friction draft gears are to be taken down not less often than once every three years, and car stencilled bearing date and station symbol at which work was done. On foreign cars, if draft gears have more than one inch excess travel, car will be held for practical repairs, but no stencilling on the car will be necessary. Inspectors will note particularly this rule, which is to be made a feature of our line.

Coupler mechanism should be operative and free from safety appliance defects. Coupler should be of proper height—between $31\frac{1}{2}$ and $34\frac{1}{2}$ inches—and coupler contour within the limits of MCB gauge ($5\frac{1}{8}$ ").

Sub-Para. (IV)

SIDE BEARINGS

Side bearing clearance should be carefully observed on cars with metal body and truck bolsters. When balanced on center plates, it is considered good practice to have clearance of $\frac{1}{16}$ inch to $\frac{1}{8}$ inch between all four side bearings. If they are bearing hard on one side the total clearance should not be more than $\frac{1}{4}$ inch on the opposite side. On cars with wood body and truck bolsters or composite wood and metal bolster, it is con-

sidered good practice to have $\frac{1}{8}$ inch to $\frac{1}{4}$ inch clearance between all four side bearings when balanced on center plates. When car is bearing on one side it is considered good practice to have not more than $\frac{3}{8}$ inch clearance on the opposite side. Good judgment must be used by inspectors in setting out cars with excessive side bearing clearance. Kind of car, type of body bolster, and distance from center pin to side bearing have to be taken into consideration.—Decidedly excessive clearance cars must not be allowed to proceed, as they constitute a menace to other equipment.

When inspecting draft gear, the inspector should observe side bearing clearance—looking at both right and left side bearings.

Sub-Para. (V) CENTER PLATES

Body and truck center plates should be carefully inspected to see that they are not broken, are properly secured to place, bolts and nuts tight and center pin in position, properly secured to prevent loss when car is turned over on dumping machines. It is to be particularly observed whether top and bottom center plates are binding, as overlooking of this trouble has resulted in a number of derailments.

Sub-Para. (VI) ARCH BARS AND TRUCK SIDES

Arch bars should be inspected for cracks, especially in bends and at column bolt holes. This may be more effective after first giving the edge of arch bar several taps with inspector's hammer so as to loosen up rust at cracks and flaws, as cracks can then be more readily detected. Seams and flaws are usually found at the bends and at column bolt holes, especially at bottom of column post on edge of arch bar. (Arch bars should not be welded in bend or at bolt holes or between the journal box or column and box bolt holes.) Trucks with cast steel side frames, such as Bettendorf, Andrews, Vulcan, Scullan, Ajax, and others, should be gone over carefully to discover flaws or cracks that might exist, which would endanger their safety. The same tapping with hammer as on arch bars should be required on cast steel side frames. These frames are not considered safe for service when found cracked or with flaws more than *one inch back from any edge of frame*.

The fact that so many cast steel side frames fail in the tension (lower length of the truss) members, is conclusive evidence of weakness in design, and this should be especially looked for by inspectors.

In addition to observing whether cracks exist in archbars and trucksides, lateral bends in center should be sharply watched for, and where found car taken out of service at once, as serious derailments result from these defects.

Sub-Para. (VII) TRUCKS

Many failures result from oil box and column nuts missing, and in many cases it is necessary to apply new bolts on account of worn or otherwise damaged threads. This is in many cases due to improper application in

the first place.—When the nut is tightened up the carman should take his hammer and give the head of bolt three or four sharp blows to help remove any rust, paint or dirt between head of bolt and bearing surface, or nut and bearing surface. Following these blows a previously tight nut will generally screw up a quarter to one whole turn, and this latter tightening makes all the difference as to how long the bolt will remain in a fully useful position.—Either boss or double nuts should be employed, and these also applied properly.

Inspectors should bear these facts in mind, and tighten up at once oil box or column bolts found in any way loose.

Sub-Para. (VIII) FOUNDATION BRAKE RIGGING

Much stress is laid upon the necessity for air brakes being properly maintained, but the results required cannot be obtained unless the foundation brake rigging also is kept in good order.—Repair tracks have instructions regarding the work connected with foundation brake rigging, which, if followed, will eliminate many troubles, but inspectors must not assume that these instructions have been adhered to, and must examine foundation brake rigging very carefully.

It should be seen that brake hanger bolts and pins have spring cotters, split keys or nuts to keep them in position.—All parts of the rigging should be securely held in place. A sharp look-out must be kept for bolts and pins worn excessively, or flaws in brake hanger forgings. Brake hangers should not be made from threaded iron, but if it has to be used the threads must not be allowed at contact points. They are to be replaced when eye or suspension part is worn to $\frac{1}{2}$ " thickness. Brake hangers are occasionally made from burnt iron, or are burnt in welding, and inspectors will be on the look out for such defects, and order hangers removed. Brake shoes are not to be allowed to wear down so that the brake head makes contact with the wheel.—Brake heads must not be left in service with metal at suspension point worn beyond 50% of the original thickness.

Safety devices are being applied gradually to all brake beams, but cars without them must be watched at all times at all inspection points, to see that beams do not come down on track, as derailments will invariably result.

• Cars must be equipped with all-metal brake beams. No. 1 brake beams must not be used on cars having a light weight in excess of 35,000 pounds. No. 2 brake beams must be applied to all cars built after January 1st, 1917, or receiving general repairs since October 1st, 1918, unless conditions require a stronger beam (say No. 3). The letters "MCB" and number are stamped on strut of all brake beams.

Sub-Para. (IX) ROOFS

A train is never properly inspected unless the roofs are examined. Safety Appliance requirements explain fully what is necessary in connection with the roof of a car, but in addition to inspecting for these defects, a look-out

must be kept for anything which may lead to a freight claim being made against the Company. Loose boards, or loose nails and screws, are fruitful sources of trouble, while leakage around grabs can often be detected by the shop inspector.

The inspection of roof must be regarded as fully necessary to the proper inspection of a train.

Sub-Para. (X)

FLOORS

Bottom side of floors of cars should be inspected automatically by inspectors when examining foundation brake rigging etc. Unless this is done, leakages resulting from holes in floors will proceed long distances without being detected, and claims result. With heavy loads there sometimes occurs a danger from the floor breaking away, and this will be quickly discovered if floors are looked over as described above.

Sub-Para. (XI)

DOORS

Careful inspection of doors should be made to see that the bottom side-door guides are in place and tight, to prevent leakage or pilferage.

Cars loaded without proper side-door protection become bulged, and this sometimes interferes with line clearance, resulting in heavy damage to equipment, and claims being filed for freight losses.

At interchange points the strictest watch is necessary, and redress for any failure on the part of connecting lines, account not providing side door protection, must be insisted upon. We do not want the whole opening closed up inside the doorway in all instances. In the case of paper stock standing vertically, a 1½"x6" strip across doorway, placed at a point equal to three quarters the height of the rolls, will protect the door. The same applies to a car loaded with barréls.

Doors must not be spiked to the car frame, but if they need fastening suitable wooden cleats or blocks should be used. Inspectors should make this known to shippers whenever possible.

Be sure that door caps, end stop and spark strips are in good order on loaded cars to prevent the elements entering and causing damage. Also see that door guides, track, *hasps*, rollers, hinge pins and fasteners are all secure and in place on empties. In the case of refrigerator cars, see that side doors fit tightly in place to prevent perishable freight being spoiled. Always see that doors of loaded stock cars are quite secure.

Sub-Para. (XII)

DOMES OF TANK CARS

Tank cars en route should never be allowed to proceed with tank outlet valve caps dangling from retaining chains, since they break off and are lost in this manner. In some instances, employes have been found opening outlet valves on the bottom of empty tank cars which have been loaded with

gasoline or other oils, to drain them. This is a very dangerous practice and is not to be permitted. Dome caps are to be properly secured and in place at all times.

Sub-Para. (XIII) LOADING RULES

There is to be a copy of the latest edition A. R. A. Loading Rules available at every inspectors' shanty. Inspectors will be expected to know these rules, and as they (inspectors) are responsible for detaining unsafe loads, the book in question is to be available for reference.

The application of common sense is generally the greatest guide in deciding whether a load is safe to proceed or not. In some instances, however, it is not only a question of safety—it may be a matter of preventing injury to lading, such as a car-load of wheels so placed that the journals would be cut by the flanges of the next wheels. An inspector would be fully expected to hold up such a shipment, and therefore some knowledge of the loading rules becomes necessary.

The heights to which grain cars may be loaded are generally marked inside of cars, but for ready reference the undermentioned table is published, based on the following weights:

Wheat	60 lbs. per bushel
Corn, Rye or Flax.....	56 lbs. per bushel
Barley	48 lbs. per bushel
Oats	32 lbs. per bushel

30-Ton Capacity Cars—8' 6" Wide Inside.

Length Inside	Wheat	Corn, Rye or Flax	Barley	Oats
31'0"	4' 9"	5' 1"	6' 0"	9' 0"
32'0"	4' 7"	4'11"	5' 9"	8' 7"
33'0"	4' 6"	4' 9"	5' 7"	8' 4"
34'0"	4' 4"	4' 8"	5' 5"	8' 1"
35'0"	4' 2"	4' 6"	5' 3"	7'10"
36'0"	4' 1"	4' 5"	5' 1"	7' 8"
37'0"	4' 0"	4' 3"	4'11"	7' 5"
38'0"	3'11"	4' 1"	4'10"	7' 3"
39'0"	3'10"	4' 0"	4' 8"	7' 1"
40'0"	3' 8"	3'11"	4' 7"	6' 9"
41'0"	3' 7"	3'10"	4' 5"	6' 7"
42'0"	3' 6"	3' 9"	4' 4"	6' 6"

40-Ton Capacity Cars—8' 6" Wide Inside.

36'0"	5' 5"	5' 9"	6' 9"	10' 2"
37'0"	5' 3"	5' 7"	6' 7"	9'11"
38'0"	5' 1"	5' 6"	6' 5"	9' 8"
39'0"	5' 0"	5' 4"	6' 3"	9' 5"
40'0"	4'11"	5' 3"	6' 1"	9' 1"
41'0"	4'10"	5' 1"	6' 0"	9' 0"
42'0"	4' 9"	5' 0"	5'10"	8' 9"
43'0"	4' 7"	4'10"	5' 9"	8' 7"
44'0"	4' 6"	4' 9"	5' 7"	8' 5"
45'0"	4' 4"	4' 8"	5' 5"	8' 3"
46'0"	4' 3"	4' 7"	5' 3"	8' 0"
47'0"	4' 1"	4' 6"	5' 2"	7'10"

40-Ton Cars—8' 9" Wide Inside

Length Inside	Wheat	Corn, Rye or Flax	Barley	Oats
36'0"	5' 3"	5' 8"	6' 7"	9'10"
37'0"	5' 1"	5' 6"	6' 5"	9' 7"
38'0"	5' 0"	5' 4"	6' 3"	9' 5"
39'0"	4'11"	5' 3"	6' 1"	9' 3"
40'0"	4' 9"	5' 1"	5'11"	9' 0"
41'0"	4' 8"	4'11"	5'10"	8'10"
42'0"	4' 6"	4'10"	5' 8"	8' 8"
43'0"	4' 5"	4' 8"	5' 7"	8' 6"
44'0"	4' 4"	4' 7"	5' 5"	8' 4"
45'0"	4' 3"	4' 6"	5' 4"	8' 1"
46'0"	4' 2"	4' 5"	5' 3"	7'10"
47'0"	4' 1"	4' 4"	5' 1"	7' 7"

50-Ton Cars—8'6" Wide Inside.

36'0"	6' 9"	7' 3"	8' 6"	12' 8"
37'0"	6' 7"	7' 0"	8' 2"	12' 5"
38'0"	6' 5"	6'11"	7'11"	12' 2"
39'0"	6' 3"	6' 9"	7' 9"	11'10"
40'0"	6' 1"	6' 7"	7' 7"	11' 6"
41'0"	6' 0"	6' 6"	7' 6"	11' 4"
42'0"	5'10"	6' 5"	7' 5"	11' 1"
43'0"	5' 9"	6' 3"	7' 4"	10' 8"
44'0"	5' 7"	6' 1"	7' 2"	10' 4"
45'0"	5' 5"	5'11"	7' 0"	10' 1"
46'0"	5' 3"	5' 9"	6'11"	9'11"
47'0"	5' 2"	5' 7"	6'10"	9' 9"

50-Ton Cars 8' 9" Wide Inside.

36'0"	6' 7"	7' 1"	8' 3"	12' 6"
37'0"	6' 5"	6'11"	8' 1"	12' 3"
38'0"	6' 3"	6' 9"	7'11"	12' 0"
39'0"	6' 1"	6' 7"	7' 8"	11' 6"
40'0"	5'11"	6' 4"	7' 5"	11' 1"
41'0"	5' 9"	6' 2"	7' 2"	10' 7"
42'0"	5' 7"	6' 0"	6'11"	10' 2"
43'0"	5' 5"	5'10"	6' 9"	10' 1"
44'0"	5' 4"	5' 8"	6' 7"	10' 0"
45'0"	5' 3"	5' 7"	6' 6"	9'11"
46'0"	5' 2"	5' 6"	6' 5"	9' 9"
47'0"	5' 1"	5' 5"	6' 4"	9' 8"

Lumber loaded on flat or coal cars should be especially carefully watched, as these loads frequently shift, and unless they are set out, restaked and given necessary attention are liable to cause wrecks or accidents. In ordering cars set out inspectors will take a proper record of where car was loaded, destination etc., and state whether staking or wiring was deficient, so the matter may be taken up and corrected at initial loading point.

In loading, bearing pieces—especially on wooden flat cars—must be placed over the bolsters, otherwise breakage of sills is bound to result.

The necessity for correct loading and carefully following M. C. B. loading rules governing lumber, piling etc., on open top cars, should be brought to the notice of agents and shippers at every opportunity. When inspecting cars loaded or loading, stakes and wiring should be carefully examined and all precautions taken to see they are strong enough to carry load safely.

Inspectors will also bear in mind that system high side gondolas, 60 M, are not to be used in gravel service, and if found loaded or being loaded will be ordered taken out. This is on account of cars not being suitable or strong enough.

It will be well to remember that open top cars loaded with sand and gravel become fearfully overloaded in periods of rainy weather. It has been determined that sometimes as much as 6,000 lbs. additional load is encountered due to moisture absorbed and on this account all concerned are asked to guard in every reasonable way against overloading cars when such conditions prevail.

Sub-Para. (XIV) LINE CLEARANCE FOR LOADING

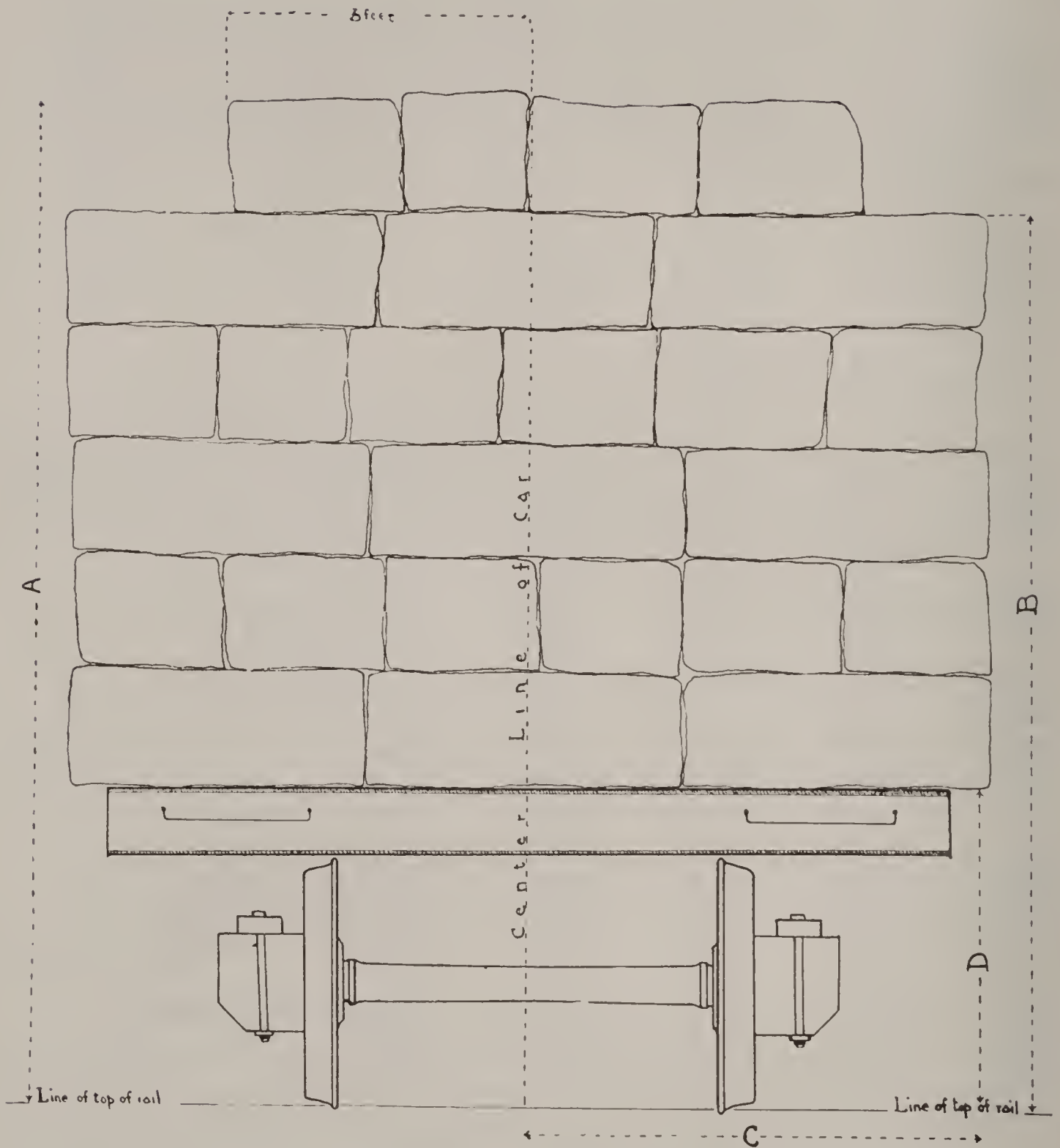
Car inspectors and agents are cautioned not to permit shippers to load cars beyond the limits prescribed in the following table for the respective roads involved, and where any doubt exists and the loaded car measures in excess of the maximum "All Line" clearance shown as the first item in table, and no detailed information is available for the Road to which car is to be delivered, instructions should be received from the proper channel before car is released for train movement.

Agents will be able to check this matter to their own satisfaction, inasmuch as they are informed as to routing and billing.

We should co-operate to avoid having to transfer cars at connections on account of limitations called for being exceeded, and all should interest themselves in this matter. In case of doubt, the maximum clearance to pass all lines is a height of 12 ft. 6 in. (A) and a width of 9 ft. 8 in. (twice C), but most lines have a maximum height clearance of about 14 ft. and a width of 10 ft. 3 in.

A	B	C	D	Road
Height above rail	Highest point above rail on side of car	Distance from cen- ter of car to side of Load	Clearance above rail	
12'6"	10'6"	4'10"	4'0"	Maximum to Pass All Lines
14'8"	12'0"	5' 1"	4'0"	B. & O.
15'9"	13'6"	5' 6"	4'0"	C. C. C. & Stl.
14'4"	12'6"	5' 2"	4'0"	C. & N. W.
15'3"	13'6"	6' 0"	4'0"	C. & A.
16'0"	12'0"	5' 2"	4'0"	C. R. I & P.
14'7"	12'9"	5' 0"	3'0"	C. B. & Q.
14'6"	14'2"	5' 6"	4'0"	C. M. & St. P.
14'8"	12'0"	5' 1"	4'0"	E. J. & E.
15'1"	11'0"	5' 6"	4'0"	Erie
16'0"	11'0"	5' 6"	4'0"	G. W.
14'0"	12'0"	5' 4"	4'0"	Grand Trunk
16'1"	14'3"	5' 6"	4'0"	Illinois Central
15'6"	13'6"	5' 0"	4'0"	Missouri Pacific
14'2"	12'6"	4'10"	3'0"	Michigan Central
14'9"	12'9"	5' 1"	1'0"	New York Central
15'5"	13'9"	5' 1"	4'0"	N. P.
14'9"	12'0"	5' 1"	3'0"	Pennsylvania Lines
16'0"	14'0"	5' 2"	4'0"	U. P.
16'0"	13'1"	5' 1"	4'0"	Wabash

The points at which measurements are taken are shown in attached sketch:—



**Sub-Para. (XV) HEATERS IN REFRIGERATOR
CARS**

During certain seasons of the year heaters are placed in refrigerator, and occasionally box cars. These are to protect the contents of the car against freezing, and it is important that the heaters be properly maintained to prevent heavy claims for damage to freight.

Refrigerators are to be prepared for heaters as follows:—All ice and inflammable matter must be removed from bunkers and drip pans; all doors and hatches tightly closed. Bulkheads must not be lined with paper when

heaters are to be placed in bunkers. In order to permit circulation of air, the drain pipes should be cleaned and left open before and during the process of loading, as well as while cars are in transit. When cars with ice tanks are used, heaters should be placed in ice bunkers of cars and securely braced.

Two kinds of heaters are used—Cole and Baxter type. In preparing the fuel for them use charcoal of good quality, absolutely dry, free from knots and reduced to the size of a walnut. The efficiency of the heater depends largely upon using charcoal of proper quality and size. Do not use charcoal dust in magazine. Store charcoal where it will keep perfectly dry.

The Cole heater should be operated as follows:—

(a) To fill the magazine, shove in the cut-off slide and fill the magazine with prepared charcoal, free from dust, as dust will choke down the fire. The cover of the magazine must be kept closed absolutely tight while heater is burning. This is essential to prevent draft of air from the fire pot up through the magazine. When necessary to open the cover to replenish the charcoal, that must be done quickly and covered again without delay.

(b) In order to start fire, remove fire pot and fill it in to exceed $\frac{2}{3}$ full of clean charcoal free from dust, replace fire pot. Remove starting lamp through ash pit hand door and saturate with alcohol. Light and replace starter. Then put on magazine section and lock heater with pin. Pull out slide (secured by pin) in magazine and see that fuel feeds down and close ash pit hand door.

(c) In regulating the draft slide, set same either at full heat or slow heat, as conditions require. Remember that fuel always heats up considerably hotter during the first 12 hours with either draft position.

(d) Kerosene or papers can be used in starting fire, but will cause considerable smoke until burned out. Be sure that heater has a good start before placing in car. The heater can be nailed to the floor, swung from chains from the ceiling of car, or anchored in bunkers of car by chains. The ash pit door must always be closed excepting when removing ashes or starter. The top feed lid must always be closed tight to prevent burning in magazine. To extinguish fire, simply remove pin and shove in cut-off slide. Remove ashes at least once a week and never dump them on car floor, wooden platforms or ties. Some ashes retain fire hours after dumping.

Baxter heaters should be handled in accordance with the following:—

Fire in heater can be started in car, but door or hatches in car must be left open to give draft and allow escape of gas. It is better practice to start heaters on platform in the open air:

(1) Remove magazine by unfastening hasps at bottom and lifting off.

(2) Punch hole in the center of paper starter and light there, then place on grate in bottom of fire pot and put three or four handfuls of charcoal or briquets on starter and let burn a few minutes.

(3) Fill fire pot and let blaze show before putting on magazine. This will usually take about ten minutes.

(4) Put on magazine and fasten hasps at bottom, then remove cover and fill same, shake a little and fill to capacity. Replace cover quickly and see that it is on tight. Do not use charcoal dust in the magazine. If heater has shut-off slide, pull out and place pin to keep it open. When heaters are placed in

bunkers fastened with chains, same should be located as far to side of line of top hatch as possible, place screw eye in walls even with top of heater, run chain with snap on end through screw eye and hook snap hook on link of chain. If there is screw on side of bunker facing inside of car, run other chain through and hook the same way, seeing that cover is tight. In suspending the large sized heater, fasten eye bolts or screw eyes in ceiling of car at proper distance apart to suit snaps on edge of heater top and in line with end of side doors. Leave space about 24 inches between side of car and first hook. Do not stand on heater top. Empty ash pan at terminals and dump fire pot.

Para. 5. MARKING FREIGHT CARS BAD ORDER

When a defective car is found in a train, there are three things to be considered, viz—whether it can be repaired advantageously in the train; whether the car can be switched out of the train and repaired in the transportation yard, or whether it should be sent to the repair track. In the first case, delay to the car should be considered, and if it is a load which ought to remain in the train, the inspector should endeavor to make the repairs at once.—If, however, too much train delay would result, or the repairs could not be made in the train, the next step would be to effect repairs in the yard. When a car is sent to the repair tracks, it involves delay, costs money for switching both ways, embarrasses us in our bad order situation, necessitates records and reports being made, and hampers transportation department. All light repairs such as for brake shoes, brake rods, packing, brasses etc. should be made in yards under blue flag protection.

When a car is marked Bad Order for switching out of train or sending to repair track, Bad Order Card should be securely fastened to car, and it is a good practice wherever possible to indicate on the card the principle defect or defects.—Occasionally there occurs an epidemic of cars going forward from certain points after being marked Bad Order by inspectors, on account of bad order cards being removed by maliciously inclined persons: at places where this trouble is encountered an additional precaution of chalk-marking the car should be resorted to. It is also advisable to institute a check to place responsibility, and when the person removing bad order cards is found, the matter must be reported to the Master Car Builder, regardless of sentiment. Inspectors or others failing to so report cases referred to, will themselves be taken out of service, as the removal of bad order cards constitutes a positive menace to the safety of the railroad.

In chalk marking cars Dixon waterproof yellow crayon is strictly prohibited. This is for wheel and metal marking only.

Para. 6. MAKING LIGHT REPAIRS IN TRAINS AND TRANSPORTATION YARDS

Once a defect develops on a car it has to be fixed. The question is simply when and where.—In the majority of cases the time is as soon as discovered, and it is merely a matter for decision as to the best place—in the train or yard, or on the repair track. As a check is made of cars going to repair tracks unnecessarily, defects are often allowed to remain, instead of being fixed in the train or yard. In consequence cars that could be re-

paired for a few dollars ultimately reach repair tracks in such shape that considerable time and money has to be spent to put them in shape, due to an extension in service of original defects.

A vigorous policy of making light repairs in trains and yards is at all times very desirable—during busy periods it is an absolute necessity if the railroad is to function profitably—Points should use discretion in this matter, and place carmen in yards in proportion to the amount of work to be done. As soon as transportation yards have to regularly send light repairs cars to repair tracks, on account of insufficient men to handle them on the spot, shortage of material, lack of organization, or any other cause, the railroad is at a loss. This generally occurs during very busy periods, when offices such as the Master Car Builders have heavy demands made upon them on account of the numerous matters that center there, and local points should find means of handling the situation, notifying the District General Car Foreman, who should re-adjust forces to meet such an emergency.

To allow work to be done quickly it is necessary that in transportation yards boxes be maintained with supplies, conveniently located, and at all times properly stocked. Boxes are to have pockets to carry various sizes of nuts, washers, cotters, nut locks, pins, bolts, clevises, dust guards, journal box lids, gaskets, pipe clamps, lag screws, grab irons, knuckles, locks, knuckle pins, uncoupling levers, air hose, packing, tools brake chain, brake shoes, keys, brake hangers, finger guards and pins, carry irons, etc. all in such a manner that material may be easily and promptly located as desired. Boxes are to be maintained in this order at all times.

Para. 7. INTERCHANGE OF FREIGHT CARS

Sub-Para. (I) GENERAL PRINCIPLES

The movement of freight from West to East is generally greater than from East to West.—As a result our equipment finds its way to Eastern roads, who, having a surplus at destination, are compelled to send us a proportion of empties.—Movements of course are irregular, varying and fluctuating with the general trend of business, but the above represents the general tendency. In consequence Eastern Railroads have a certain choice of cars, and may retain our equipment and send us cars not so suited for operation on our road. This situation is guarded against somewhat by A. R. A. rules which provide a higher per diem for cars detained over a certain period. However, these rules by no means entirely correct the situation, and it is the Interchange Inspectors, stationed at the gateways to our road, who can, more than anyone else, safeguard the interests of the road by regulating the class of equipment finding its way on to our lines.

The basic rule for interchange is that the receiving line shall be the judge as to the safety of any equipment offered for service. This rule largely places the matter in our own hands to prevent the road being swamped with poor class wooden underframe equipment, sagging in center, and without the means of tightening up to stand the strains imposed by our heavy trains.

It is generally considered poor policy to refuse business, but inspectors must be alive to what is involved by accepting radically weak equipment, even under load.—These cars take weeks to find their way across the country, visiting every repair track en route, and finally leave the road after earning so little that the resultant profit will not cover the per diem, plus the cost of switching and repairs for which no bill can be rendered. Inspectors will therefore not hesitate to refuse loaded cars destined to points involving long haulage over our road, where cars are unsuited, but will accept the load and refuse the car. Where the class of car referred to is offered in any quantity, the inspector or foreman should consult with local agent or superintendent, and come to an understanding so that transportation department will not be embarrassed, but the thought must be always kept in mind that the flooding of our road with poor equipment has to be intelligently guarded against.

In this regard it should be noted that other roads with which we interchange will in some cases adopt a reciprocal attitude, and we will require to offer them cars in reasonable physical condition, other than, of course, their own equipment being returned.

Sub-Para. (II) DEFECTS FOR WHICH CARS TO BE REFUSED

Cars will be refused in interchange with any safety appliance defects. If the car has any defects which, if repaired by us could not be billed for against the owner, the car must not be accepted unless it has a defect card properly attached. Defect card will not be required if damage is so slight that no repairs are necessary, but in the case of refrigerator cars sprayed and smeared up with lime, done when standing around disinfecting tracks at stock yards, the car must not be accepted unless the connecting line gives us a defect card covering the cleaning of the car and putting it in fit shape to make a presentable appearance. Defect cards will not be required of the delivering company for wrong repairs that were not made by it.

Cars offered in interchange incorrectly loaded or with load shifted, requiring adjustment transfer, will require a transfer authority card covering the work.

Cars with old air dates, other than our own equipment, will not be accepted in interchange, excepting under load, and similarly we will not offer cars with air dates in excess of twelve months. Cars equipped with stem or spindle coupler attachments, or American continuous draft rods, will not be offered in interchange.

Sub-Para. (III) DETAILS OF INTERCHANGE

The various forms to be used, records to be kept, and procedure to be followed are fully covered under Administration later in this book.

At outlying points where, joint inspection is not in effect, matters are left to the judgment of the receiving line, but where joint interchange inspectors are employed, the decision will be made by the chief interchange inspector.

Para. 8**SAFETY APPLIANCES****Sub-Para. (I)****GENERAL OUTLINE**

Safety Appliances and their maintenance play a very important part in railroading. So that all concerned may be fully cognizant of requirements, our own rules for Safety Appliance Standards are published in full.

The standards laid down meet all requirements of the Safety Appliance Acts, and Orders of the Interstate Commerce Commission.—They also embody additional requirements found by experience to be desirable, indicated as “preferable”.

To give ready access to information concerning safety appliances, the consist thereof is included herein.

- 1. PURPOSE**
- 2. HISTORY**
- 3. THE SAFETY APPLIANCE ACTS.**
- 4. ORDER OF THE INTERSTATE COMMERCE COMMISSION.**
- 5. CIRCULAR OF THE MASTER CAR BUILDERS ASSOCIATION.**
- 6. GENERAL RULES FOR GOOD PRACTICE. (Including General Definitions)**
- 7. FREIGHT CAR SAFETY APPLIANCE REQUIREMENTS.**
 - (1) Requirements common to all Freight Cars.
 - (2) Box and Other House Cars.
 - (3) Hopper Cars & High-Side Gondolas with Fixed Ends.
 - (4) Drop End High-Side Gondola Cars.
 - (5) Fixed-End Low-Side Gondola Cars.
 - (6) Drop End Low-Side Gondola Cars.
 - (7) Flat Cars.
 - (8) Tank Cars with Side Platforms.
 - (9) Tank Cars without Side Sills and Tank Cars with short Side Sills and End Platforms.
 - (10) Tank Cars without End Sills.
 - (11) Caboose Cars with Platforms.
 - (12) Caboose Cars without Platforms.
 - (13) Special Memoranda on Freight Cars. (Including Definitions)
- 8. PASSENGER CAR SAFETY APPLIANCE REQUIREMENTS.**
 - (1) Requirements common to all Passenger Cars.
 - (2) Passenger Train Cars with wide vestibules.
 - (3) Passenger train Cars with open end platforms.
 - (4) Passenger Train Cars without end platforms.
 - (5) Special Memoranda on Passenger Cars. (Including Definitions)
- 9. STEAM LOCOMOTIVE SAFETY APPLIANCE REQUIREMENTS.**
 - (1) Requirements common to all Steam Locomotives.
 - (2) Steam Locomotives used in Road Service.
 - (3) Steam Locomotives used in Switching Service.
 - (4) Special Memoranda on Steam Locomotives. (Including Definitions)

10. ELECTRIC LOCOMOTIVE SAFETY APPLIANCE REQUIREMENTS

- (1) Requirements common to all Electric Locomotives.
- (2) Electric Locomotives used in road service.
- (3) Electric Locomotives used in Switching Service.
- (4) Special Memoranda on Electric Locomotives. (Including Definitions)

11. ELECTRIC, GAS-ELECTRIC, OIL, STEAM, AND GASOLINE MOTOR CAR SAFETY APPLIANCE REQUIREMENTS.

- (1) Requirements for above Motor Cars.
- (2) Special Memoranda on Motor Cars.

12. CLASSIFICATION OF DEFECTS TO BE REPORTED BY GOVERNMENT INSPECTORS.**Sub-Para. (II)****PURPOSE**

The number of personal injuries and deaths resulting from the operation of railroads was so large that in 1893 Congress passed the first "Safety Appliance Act", followed later by additional acts, authorizing the Interstate Commerce Commission to promulgate rules to be followed by railroads in equipping and maintaining safety appliances on rolling stock.

While the passage of these Acts and the endorsement of the Commission's Orders have in a natural course brought about better train operation, their main purpose of reducing injuries and deaths has been highly satisfactory, as shown by official statistics.

Sub-Para. (III)**HISTORY**

The original Safety Appliance Act was passed March 2nd, 1893, supplementary acts being passed March 2nd, 1903, May 30th, 1908, and April 14th, 1910. The Acts authorized and directed the Interstate Commerce Commission to prescribe certain appliances to be maintained, giving the number, location, dimensions and manner of application. On March 13th, 1911, the Order prescribing standard appliances was issued.

The order was compiled and various limiting dimensions agreed upon after measuring numerous men of various sizes, ascertaining comfortable distances for them to step up, step across, reach up, around and down, and in fact every movement a man would have to make in getting on, off or over locomotives and cars. From this data they prescribed the Order which is embodied hereinafter.

Sub-Para. (IV)**THE SAFETY APPLIANCE ACTS**

(March 2, 1893. Amended April 1, 1896)

An Act to promote the safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving-wheel brakes, and for other purposes.

Driving-wheel and trainbrakes. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That on and after the first day of January, eighteen hundred and ninety-eight, it shall be unlawful for any common carrier engaged in in-

terstate commerce by railroad to use on its line any locomotive engine in moving interstate traffic not equipped with a power driving-wheel brake and appliances for operating the train-brake system, or to run any train in such traffic after said date that has not a sufficient number of cars in it so equipped with power or train brakes that the engineer on the locomotive drawing such train can control its speed without requiring brakemen to use the common hand brake for that purpose.

[Excerpts of Court Decisions: *Virginian R. R. vs U. S.* 223 Fed. 748

"It was the intention of Congress by the power brake provision of the safety appliance acts to make it unlawful to require brakemen to use handbrakes in the *ordinary* movement of freight trains."

U. S. vs G. N. 229 Fed. 927.

"The power brake provision of the safety appliance act is mandatory in requiring that trains must not only be equipped to run, but must actually be run without requiring brakemen to use hand brakes in the *ordinary* movement of trains."]

*Automatic
couplers.*

SEC. 2. That on and after the first day of January, eighteen hundred and ninety eight, it shall be unlawful for any such common carrier to haul or permit to be hauled or used on its line any car used in moving interstate traffic not equipped with couplers coupling automatically by impact, and which can be uncoupled without the necessity of men going between the ends of the cars.

[Excerpt of Court Decision: *Johnson vs Sou. Pac.*, Dec. 19-1904; Chief Justice Fuller.

"We dismiss as without merit the suggestion which has been made, that the words 'without the necessity of men going between the ends of cars which are the test of compliance with section 2 apply only to the act of uncoupling. The phrase literally covers both coupling and uncoupling, and if read, as it should be, with a comma after the word 'uncoupled' this becomes entirely clear."]

*When carriers may
lawfully refuse to
receive cars from
connecting lines or
shippers.*

SEC. 3. That when any person, firm, company, or corporation engaged in interstate commerce by railroad shall have equipped a sufficient number of its cars so as to comply with the provisions of section one of this Act, it may lawfully refuse to receive from connecting lines of road or shippers any cars not equipped sufficiently, in accordance with the first section of this Act, with such power or train brakes as will work and readily interchange with the brakes in use or on its own cars, as required by this act.

*Grab irons and
Handholds.*

SEC. 4. That from and after the first day of July, eighteen hundred and ninety-five, until otherwise ordered by the Interstate Commerce Commission, it shall be unlawful for any railroad company to use any car in interstate commerce that is not provided with secure grab irons or handholds in the ends and sides of each car for greater security to men coupling and uncoupling cars.

*Standard Height
of drawbars for
freight cars.*

SEC. 5. That within ninety days from the passage of this Act the American Railway Association is authorized hereby to designate to the Interstate Commerce Commission the standard height of draw bars for freight cars, measured perpendicular from the level of the tops of the rails to the centers of the draw-

bars for each of the several gauges of railroads in use in the United States and shall fix a maximum variation from such standard height to be allowed between the drawbars of empty and loaded cars. Upon their determination being certified to the Interstate Commerce Commission, said Commission shall at once give notice of the standard fixed upon to all common carriers, owners, or lessees engaged in interstate commerce in the United States by such means as the Commission may deem proper. But should said association fail to determine a standard as above provided, it shall be the duty of the Interstate Commerce Commission to do so, before July first, eighteen hundred and ninety-four, and immediately to give notice thereof as aforesaid. And after July first, eighteen hundred and ninety-five, no cars, either loaded or unloaded, shall be used in interstate traffic which do not comply with the standard above provided for.

Penalty for violation of the provisions of this act.

Duty of United States district attorney.

Duty of interstate Commerce Commission.

Exceptions to the act.

nothing in this Act contained shall apply to trains composed of four-wheel cars or to trains composed of eight-wheel standard logging cars where the height of such car from top of rail to center of coupling does not exceed twenty-five inches, or to locomotives used in hauling such trains when such cars or locomotives are exclusively used for the transportation of logs.

SEC. 6. (As amended April 1, 1896.) That any such common carrier using any locomotive engine, running any train, or hauling or permitting to be hauled or used on its line *any car* in violation of any of the provisions of this act, shall be liable to a penalty of *one hundred dollars* for each and every such violation to be recovered in a suit or suits to be brought by the United States district attorney in the district court of the United States having jurisdiction in the locality where such violation shall have been committed; and it shall be the duty of such district attorney to bring such suits upon duly verified information being lodged with him of such violation having occurred: and it shall also be the duty of the Interstate Commerce Commission to lodge with the proper district attorneys information of any such violations as may come to its knowledge: *Provided*, That

[Excerpts of Court Decisions: St. L. S. W. vs. U. S. 183 Fed. 770.

"In a prosecution for the recovery of the statutory penalty, the defendant is liable as to each and every car used or hauled in violation of the Acts."

U. S. vs. C. G. W. 162 Fed. 775.

"In a prosecution for the recovery of the statutory penalty, the ownership of the cars involved is immaterial, and the defendant is liable for the use or hauling of a foreign car in violation of the Acts."]

Power of Interstate Commerce Commission to extend time to carriers to comply with this act.

Employees not deemed to assume risk of employment.

SEC. 7 That the Interstate Commerce Commission may from time to time upon full hearing and for good cause extend the period within which any common carrier shall comply with the provisions of this Act.

SEC. 8. That any employee of any such common carrier who may be injured by any locomotive, car or train in use contrary to the provisions of this Act shall not be deemed thereby to have assumed the risk thereby occasioned, although continuing in the employment of such carrier after the unlawful use of such locomotive, car, or train had been brought to his knowledge. Public No. 113, approved March 2, 1893, amended April 1, 1896.

Note:—Prescribed standard height of drawbars: *Standard-gauge railroads*; maximum 34½, minimum 31½ inches; narrow-gauge railroads: maximum 26, minimum, 23 inches; 2-foot-gauge railroads: maximum 17½, minimum 14½ inches.

[Excerpt of Court Decision: C. M. & P. S. vs. U. S., 196 Fed., 882.

"The Acts prohibit the use of a coupler the drawbar of which is lower than the standard height, even though such coupler is on the front end of a locomotive."]

March 2, 1903

An Act to amend an Act entitled "An Act to promote the safety of Employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving-wheel brakes, and for other purposes," approved March second, eighteen hundred and ninety-three, and amended April first, eighteen hundred and ninety-six.

Safety-Appliance act of Mar. 2, 1893 as amended by act of Apr. 1, 1896, shall apply in Territories and District of Columbia.

Provisions of safety-appliance acts as to couplers are to apply in all cases when couplers are brought together.

Safety-appliance acts shall apply to all equipment of any railroad engaged in interstate commerce.

Exceptions.

those trains, cars, and locomotives exempted by the provisions of section six of said Act of March second, eighteen hundred and ninety-three, as amended by the Act of April first, eighteen hundred and ninety-six, or which are used upon street railways.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the provisions and requirements of the Act entitled, "An Act to promote the safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving-wheel brakes, and for other purposes," approved March second, eighteen hundred and ninety-three, and amended April first, eighteen hundred and ninety-six, shall be held to apply to common carriers by railroads in the Territories and the District of Columbia and shall apply in all cases, whether or not the couplers brought together are of the same kind, make, or type; and the provisions and requirements hereof and of said Acts, relating to train brakes, automatic couplers, grab irons, and the height of drawbars shall be held to apply to all trains, locomotives, tenders, cars, and similar vehicles used on any railroad engaged in interstate commerce, and in the territories and the District of Columbia, and to all other locomotives, tenders, cars, and similar vehicles used in connection therewith, excepting

[Excerpts of Court Decisions: Soo Ry. vs. U. S. No. 28 U. S. supreme Court.

"When the words 'on any railroad engaged in interstate commerce' are given their natural signification, as presumptively they should be, the scope of the clause is such that the true test of its application is the use of the vehicle on a railroad which is a highway of interstate commerce, and not its use in moving interstate traffic. In the instance of a train composed of many cars, some moving interstate traffic and others moving *intrastate* traffic, would by their concurrent operation bring the entire train within the statute. The act is intended to embrace all locomotives, cars and similar vehicles used on any railroad which is a highway of interstate commerce."

C. M. & St. P. Ry. vs. U. S. 196 Fed. 882.

"The locomotive at the head of a freight train is a 'freight car' within the purview of the Acts."]

<p><i>Power or train brakes on not less than 50 percent of cars in trains shall be used and operated (now 85%)</i></p> <p><i>Comission may increase minimum percentage of power or train brake cars to be used.</i></p> <p><i>Penalty.</i></p>	<p>SEC. 2. That whenever as provided in said Act, any train is operated with power or train brakes, not less than fifty per centum (now 85%) of the cars in such train shall have their brakes used and operated by the engineer of the locomotive drawing such train; and all power-braked cars in such train which are associated together with said fifty per centum (now 85%) shall have their brakes so used and operated; and, to more fully carry into effect the objects of said Act, the Interstate Commerce Commission may, from time to time, after full hearing, increase the minimum percentage of cars in any train required to be operated with power or train brakes which must have their brakes used and operated as aforesaid; and failure to comply with any</p>
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such requirement of the said Interstate Commerce Commission shall be subject to the like penalty as failure to comply with any requirement of this section.

<p><i>Act effective Sept. 1, 1903</i></p> <p><i>Provisions, powers, duties, requirements, and liabilities, specified in act of Mar. 2, 1893, and act of Apr. 1, 1896, apply to this act.</i></p>	<p>SEC. 3. That the provisions of this Act shall not take effect until September first, nineteen hundred and three. Nothing in this Act shall be held or construed to relieve any common carrier, the Interstate Commerce Commission, or any United States district attorney from any of the provisions, powers, duties, liabilities, or requirements of said Act of March second, eighteen hundred and ninety-three, as amended by the Act of April first, eighteen hundred and ninety-six; and all of the provisions, powers, duties, requirements, and liabilities of said Act of March second, eighteen hundred and ninety-three, as amended by the Act of April first, eighteen</p>
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hundred and ninety-six, shall except as specifically amended by this Act, apply to this Act.

Public, No. 133, approved March 2, 1903. .

Note:—Order of Commission of June 6, 1910.

It is ordered, That on and after September 1, 1910, on all railroads used in interstate commerce, whenever, as required by the safety appliance act as amended March 2, 1903, *any train*, is operated with power or train brakes, not less than 85 per cent of the cars of such train shall have their brakes used and operated by the engineer of the locomotive drawing such train, and all power-brake cars in every such train which are associated together with the 85 per cent shall have their brakes so used and operated.

[Excerpt of Court Decision: U. S. vs. St. L. I. M. & S. No. 1149.

"The fact that a string of cars is handled by a switch engine and a switching crew does not make such movement a switching operation within that term as used by the Supreme Court, if such movement were in fact over a main line track where the employes were exposed to hazards which made it essential that appliances be at hand for readily and quickly controlling the speed of such train."

U. S. vs. N. P. No. 88 Supreme Court Oct. 1920.

"There is nothing in the Act which limits the application of the provision to operations on main line tracks. A moving locomotive with car attached is without the provision of the Act only when *it is not a train*, as where operation is that of *switching, classifying and assembling cars within railroad yards for the purpose of making up trains.*"]

April 14, 1910

An Act to supplement "An Act to promote the safety of employes and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving wheel brakes and for other purposes," and other safety appliance Acts, and for other purposes.

To what carriers applicable. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that the provisions of this Act shall apply to every common carrier and every vehicle subject to the Act of March second, eighteen hundred and ninety-three, as amended April first, eighteen hundred and ninety-six, and March second, nineteen hundred and three, commonly known as the "Safety Appliance Acts."

Cars to be equipped with sill steps, hand brakes, ladders, running boards, and grab irons. SEC. 2. That on and after July first, nineteen hundred and eleven, it shall be unlawful for any common carrier subject to the provisions of this Act to haul, or permit to be hauled or used on its line any car subject to the provisions of this Act not equipped with appliances provided for in this Act, to wit: All cars must be equipped with secure sill steps and efficient hand brakes; all cars requiring secure ladders and secure running boards shall be equipped with such ladders and running boards, and all cars having ladders shall also be equipped with secure hand holds or grab irons on their roofs at the tops of such ladders: *Provided*, That in the loading and hauling of long commodities, requiring more than one car, the hand brakes may be omitted on all save one of the cars while they are thus combined for such purpose.

[Excerpt of Court Decision: U. S. vs. I. C. 177 Fed. 801.

"A hand brake on a car being rendered inoperative by reason of the lading thereon having been shifted and pressed against the brake is an inefficient brake."]

Commission to designate number, dimensions, location, and manner of application of appliances. SEC. 3. That within six months from the passage of this Act the Interstate Commerce Commission, after hearing, shall designate the number, dimensions, location, and manner of application of the appliances provided for by section two of this Act and section four of the Act of March second, eighteen hundred and ninety-three, and shall give notice of such designation to all common carriers subject to the provisions of this Act by such means as the Commission may deem proper, and thereafter said number, location, dimensions, and manner of application as designated by said Commission shall remain as the standards of equipment to be used on all cars subject to the provisions of this act, unless changed by an order of said Interstate Commerce Commission, to be made after full hearing and for good cause shown; *and failure to comply with any such requirement of the Interstate Commerce Commission shall be subject to a like penalty as failure to comply with any requirement of this Act:*

Period of compliance may be extended. *Commission may modify height of drawbars.* *Provided*, That the Interstate Commerce Commission may, upon full hearing and for good cause, extend the period within which any common carrier shall comply with the provisions of this section with respect to the equipment of cars actually in service upon the date of the passage of this Act. Said Commission is hereby given authority after hear-

Present standard height of drawbars legal. ing, to modify or change, and to prescribe the standard height of drawbars and to fix the time within which such modification or change shall become effective and obligatory, and prior to the time so fixed it shall be unlawful to use any car or vehicle in interstate or foreign traffic which does not comply with the standard now fixed or the standard so prescribed, and after the time so fixed it shall be unlawful to use any car or vehicle in interstate or foreign traffic which does not comply with the standard so prescribed by the Commission.

Penalty for violation of provisions of this act. SEC. 4. That any common carrier subject to this act using, hauling, or permitting to be used or hauled on its line any car subject to the requirements of this Act not equipped as provided in this Act shall be liable to a penalty of *one hundred dollars* for each and every such violation, to be recovered as provided in section six of the Act of March second, eighteen hundred and ninety-three, as amended April first, eighteen hundred and ninety-six: *Provided*: That where any

Defective cars may be hauled to nearest available repair point. car shall have been properly equipped, as provided in this Act and the other Acts mentioned herein and such equipment shall have become defective or insecure while such car was being used by such carrier upon *its* line of railroad, such car may be hauled from the place where such equipment was

Carriers not relieved from liability for death or injury. first discovered to be defective or insecure to the *nearest available point* where such car can be repaired, without liability for the penalties imposed by section four of this act or section six of the Act of March second, eighteen hundred and ninety-three, as amended by the Act of April first, eighteen hundred and ninety-six, *if such movement is necessary to make such repairs and such repairs can not be made except at such repair point*; and such movement or hauling of such car shall be at the sole risk of the carrier, and nothing in this section shall be construed to relieve such carrier from liability in any remedial action for the death or injury of any railroad employee caused to such employee by reason of or in connection with the movement or hauling of such car with equipment which is defective or insecure or which is not maintained in accordance with the requirements of this Act and the other Acts herein referred to; and *nothing* in this proviso shall be construed to permit the hauling of defective cars by means of chains instead of drawbars, in *revenue* trains or in association with other cars that are *commercially used*, unless such defective cars contain live stock or "perishable" freight.

Hauling by chains. first discovered to be defective or insecure to the *nearest available point* where such car can be repaired, without liability for the penalties imposed by section four of this act or section six of the Act of March second, eighteen hundred and ninety-three, as amended by the Act of April first, eighteen hundred and ninety-six, *if such movement is necessary to make such repairs and such repairs can not be made except at such repair point*; and such movement or hauling of such car shall be at the sole risk of the carrier, and nothing in this section shall be construed to relieve such carrier from liability in any remedial action for the death or injury of any railroad employee caused to such employee by reason of or in connection with the movement or hauling of such car with equipment which is defective or insecure or which is not maintained in accordance with the requirements of this Act and the other Acts herein referred to; and *nothing* in this proviso shall be construed to permit the hauling of defective cars by means of chains instead of drawbars, in *revenue* trains or in association with other cars that are *commercially used*, unless such defective cars contain live stock or "perishable" freight.

[Excerpt of Court Decisions: C. & O. vs. U. S. No. 1323.

"The relief granted to the carriers by the amendment of April 14, 1910, is limited by its express terms and manifest intent, and there is no warrant for further extension. It permits the transfer without penalty of a disabled car to the 'nearest available point' where it can be repaired, provided such transfer is necessary because the defects cannot be remedied at the point where they are first discovered, and that is the only movement which does not subject the carrier to liability. The movement of a defective car, not for repairs or in any other than commercial service, renders the carrier liable although ignorant of the defect, and the amendment affords no protection."

D. & R. G. vs. U. S., No. 4862.

"Such car may not be handled for the purpose of delivering its load to the consignee even when unloading is necessary for repair, unless it be affirmatively shown that such delivery involves no more movement or handling of the car than unloading it or transferring its load."

C. & N. W. vs. U. S. 168 Fed. 236.

"Cars are commercially used either when they are moving traffic or when, though empty, they are moving to points for the purpose of receiving traffic."]

B. & O. vs. U. S., No. 2959.

"A carrier is prohibited from hauling for repairs over *its* line a defective car which has been delivered in defective condition by a *connecting* carrier in interchange. A defective car cannot be hauled for repairs without liability, except by the carrier upon whose line it became defective while being used."

U. S. vs. C. M. & St. P. 149 Fed. 486.

"Cars used or hauled by an interstate carrier for the transportation of its own products or property are commercially used within the purview of the Acts."

U. S. vs. D. & R. G. 163 Fed. 519.

"The distance a defective car is hauled in violation of the Acts is immaterial."

Carriers not relieved from penalty except for causes above named. SEC. 5. That except that within the limits specified in the preceding section of this Act, the movement of a car with defective or insecure equipment may be made without incurring the penalty provided by the statutes, but shall in all other respects be unlawful, nothing in this Act shall be held or construed to relieve any common carrier, the Interstate Commerce Commission, or any United States attorney from any of the provisions, powers, duties, liabilities, or requirements of said Act of March second, eighteen hundred and ninety-three, as amended by the Acts of April first, eighteen hundred and ninety-six, and March second, nineteen hundred and three; and, except as aforesaid, all of the provisions, powers, duties, requirements, and liabilities of said Act of March second, eighteen hundred and ninety-three, as amended by the Acts of April first, eighteen hundred and ninety-six, and March second, nineteen hundred and three, shall apply to this Act.

Enforcement. SEC. 6. That it shall be the duty of the Interstate Commerce Commission to enforce the provisions of this Act, and all powers heretofore granted to said Commission are hereby extended to it for the purpose of the enforcement of this Act. Public, No. 133, approved April 14, 1910.

Employment of inspectors. Sundry civil act (appropriations) of June 28, 1902, authorizes Commission to employ "inspectors to execute and enforce the requirements of the safety-appliance Act."

May 30, 1908

An Act to Promote the Safety of Employees On Railroads

Ash pan equipment in interstate commerce. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That on and after the first day of January, nineteen hundred and ten, it shall be unlawful for any common carrier engaged in interstate or foreign commerce by railroad to use any locomotive in moving interstate or foreign traffic, not equipped with an ash pan, which can be dumped or emptied and cleaned without the necessity of any employee going under such locomotive.

Ash pan equipment in Territories and District of Columbia. SEC. 2. That on and after the first day of January, nineteen hundred and ten, it shall be unlawful for any common carrier by railroad in any Territory of the United States or the District of Columbia to use any locomotive not equipped with an ash pan, which can be dumped or emptied and cleaned without the necessity of any employee going under such locomotive.

Penalties. SEC. 3. That any such common carrier using any locomotive in violation of any of the provisions of this Act shall be liable to a penalty of *two hundred dollars* for each and every such violation, to be recovered in a suit or suits to be brought by the United States district attorney in the district court of the United States having jurisdiction in the locality where such violation shall have been committed; and it shall be the duty of such district attorney to bring such suits upon duly verified information being lodged with him of such violation having occurred; and it shall also be the duty of the Interstate Commerce Commission to lodge with the proper district attorneys information of any such violations as may come to its knowledge.

Powers granted to Commission. SEC. 4. That it shall be the duty of the Interstate Commerce Commission to enforce the provisions of this Act, and all powers heretofore granted to said Commission are hereby extended to it for the purpose of the enforcement of this Act.

Receivers Included. SEC. 5. That the term "common carrier" as used in this Act shall include the receiver or receivers or other person or corporations charged with the duty of the management and operation of the business of a common carrier.

Where ash pan is not necessary. SEC. 6. That nothing in this Act contained shall apply to any locomotive upon which, by reason of the use of oil, electricity, or other such agency, an ash pan is not necessary.

Public, No. 165, approved May 30, 1908.

Sub-Para. (V) INTERSTATE COMMERCE COMMISSION ORDER

At a General Session of the Interstate Commerce Commission, held at its office in Washington, D. C., on the 13th day of March, A. D. 1911. *In the Matter of Designating the Number, Dimensions, Location, and Manner of Application of Certain Safety Appliances.*

Whereas by the third section of an act of Congress approved April 14th, 1910, entitled "An act to supplement 'An act to promote the Safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving-wheel brakes, and for other purposes, "and other safety appliance acts, and for other purposes," it is provided, among other things, "That within six months from the passage of this act the Interstate Commerce Commission, after hearing, shall designate the number, dimensions, location, and manner of application of the appliances provided for by section two of this act and section four of the act of March second, eighteen hundred and ninety-three, and shall give notice of such designation to all common carriers subject to the provisions of this act by such means as the Commission may deem proper, and thereafter said number, location, dimensions, and manner of application as designated by said Commission shall remain as the standards of equipment to be used on all cars subject to the provisions of this act, unless changed by an order of said Interstate Commerce Commission, to be made after full hearing and for good cause shown; and failure to comply with any such requirement of the Interstate Commerce Commission shall be subject to a like penalty as failure to comply with any requirement of this act: *Provided*: that the Interstate Commerce Commission may, upon full hearing and for good cause, extend the

period within which any common carrier shall comply with the provisions of this section with respect to the equipment of cars actually in service upon the date of the passage of this act;" and

Whereas hearings in the matter of the number, dimensions, location, and manner of application of the appliances, as provided in said section of said act, were held before the Interstate Commerce Commission at its office in Washington, D. C., on September 29th and 30th and October 7th, 1910, respectively; and February 27th, 1911;

Now, therefore, in pursuance of and in accordance with the provisions of said section three of said act, and superseding the Commission's order of October 13th, 1910, relative thereto—

It is ordered, That the number, dimensions, location, and manner of application of the appliances provided for by section two and the act of April 14, 1910 and section four of the act of March 2nd, 1893, shall be as follows:
(Then is set out the requirement for each type of car or locomotive as shown hereinafter).

In the matter of the extension of the period within which common carriers shall comply with the requirements of an Act entitled "An act to supplement 'An act to promote the safety of employes and travelers upon railroads by compelling common carriers engaged in Interstate Commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving-wheel brakes and for other purposes,' and other safety appliance acts, and for other purposes," approved April 14, 1910, as amended by "An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30th, 1912, and for other purposes," approved March 4, 1911.

Whereas, pursuant to the provisions of the act above stated, the Interstate Commerce Commission, by its orders duly made and entered on October 13, 1910, and March 13, 1911, has designated the number, dimensions, location and manner of application of the appliances, provided for by section 2 of the act aforesaid and section 4 of the act of March 2, 1893, as amended April 1, 1896 and March 2nd, 1903, known as the "Safety Appliance Acts;" and whereas the matter of extending the period within which common carriers shall comply with the provisions of section 2 of the act first aforesaid being under consideration, upon full hearing and for good cause shown:

It is ordered, That the period of time within which said common carriers shall comply with the provisions of section 3 of said act in respect of the equipment of cars in service, on the 1st day of July, 1911, be, and the same is hereby, extended as follows, to-wit:

Freight Train Cars

(a) Carriers are not required to change the brakes from right to left side on steel or steel-underframe cars with platform end sills, or to change the end ladders on such cars, except when such appliances are renewed, at which time they must be made to comply with the standards prescribed in said order of March 13, 1911.

Note:—Cars built since July 1st, 1911 must be standard.

(d) Carriers are not required to make changes to secure additional end-ladder clearance on cars that have 10 or more inches end-ladder clearance, within 30 inches of side of car, until car is shopped for work amounting to practically rebuilding body of car, at which time they must be made to comply with the standards prescribed in said order.

Note:—Cars built since July 1st, 1911 must be standard.

(g) Carriers are not required to change the location of handholds (except end handholds under end sills), ladders, sill steps, brake wheels, and brake

staffs on freight-train cars where the appliances are within 3 inches of the required location, except that when cars undergo regular repairs they must then be made to comply with the standards prescribed in said order.

Note:—Cars built since July 1st, 1911 must be standard.

(Other paragraphs of this section of the order have lapsed, and are therefore omitted).

(The above sub-para. is published for information only. It quotes the official wording used, and represents the usual formalities necessary in connection with the drawing up and publishing of an Order.)

Sub-Para. (VI) MASTER CAR BUILDERS' ASSOCIATION CIRCULAR

Under the Safety Appliance Act, provision is made for the application of Safety appliances to freight cars under two plans, one for cars built prior to July 1, 1911, and one for cars built on or after July 1, 1911.

The stencilling of cars was adopted by the Master Car Builders' Association for the convenience of the inspectors. In its report to the convention of 1911 (see pages 251 and 252, Proceedings, 1911), the Committee on Safety Appliances recommended the adoption of designating marks for cars equipped with the United States Safety Appliances, Standard, in the following language:

"The Interstate Commerce Commission's order prescribed that all cars built on or after July 1, 1911, shall be equipped with the United States Safety Appliance Standards, and whereas there are various exceptions in the case of equipment built prior to July 1, 1911, it will be necessary to have two designating marks, that a car may readily show whether it comes under the rules for equipment built on or after July 1, 1911, or under the rules for equipment built prior to July 1, 1911.

"The Committee recommends the following designating marks for cars built on or after July 1, 1911:

UNITED STATES SAFETY APPLIANCES, STANDARD.

"And for cars built prior to July 1, 1911:

UNITED STATES SAFETY APPLIANCES.

These markings to be used on each side of the car; letters, if stencilled, to be not less than 1 inch in height, as per M. C. B. Standards for lettering for freight cars, Sheet M. C. B. 27; letters, if on a metal badge plate, to be not less than $\frac{1}{2}$ inch in height and raised not less than $\frac{1}{16}$ inch, and have not less than $\frac{1}{8}$ inch bar or staff; the arrangement of the words should be as near as possible as shown above.

"A metal badge plate $3\frac{1}{2}$ by 10 inches, with the proper marking, is preferred, one plate to be secured on each side of the car by four bolts or rivets if on metal cars, and by four bolts or screws if on wooden cars, the bolts, rivets or screws to be not less than $\frac{1}{4}$ inch diameter."

In addition to adopting the United States Safety Appliances as a Standard, the Association also adopted as standard the above requirements as to marking and stencilling cars; therefore, it is of the utmost importance that all cars be so marked when properly equipped.

Note:—A car, meeting all the requirements of the Order of March 13, 1911, regardless of date built, should be stencilled "United States Safety Appliances Standard," even tho it be equipped with the so-called "temporary" extended $12\frac{1}{4}$ " head coupler.

**Sub-Para. (VII) GENERAL RULES FOR GOOD
PRACTICE**

1. When engines or cars are undergoing heavy repairs, or parts affected are applied as new, it will be the policy of this Company to set all safety appliances to meet "preferred" measurements. In many cases minimum and preferred clearances or measurements are quoted, in order not to inflict hardships on Companies by compelling undue alteration of equipment, but it is safe to assume that at some future date the preferred measurement will become the one necessary by law. To meet this condition and for the sake of good practice, preferred specifications will be adopted under the circumstances mentioned.

2. All gauges used, such as for coupler height, coupler contour, foot-board height, etc., should be carefully checked to insure accuracy.

3. The engine inspector will obtain greater efficiency by going over his locomotive for safety appliance defects separately, at which time he should measure or test each appliance or clearance about which he is in any way doubtful.

4. Engines should be inspected while passing over turn table for height of couplers, footboards, sill steps, etc. Turntables are level, but tracks in the majority of roundhouses often cannot be depended upon. Dimensions found incorrect should be chalk-marked, at time of measuring, in a convenient location, such as face of knuckle.

General Definitions

Minimum clearance. The term "Minimum Clearance" as used herein, applies to the entire length of each appliance to which it refers. If the length of any appliance exceeds the prescribed dimensions, such additional length shall conform to the minimum clearance requirement. The *minimum clearance* of any appliance shall not be obstructed or its use interfered with by any other appliance or part of car.

Hand Brake. The term "Hand Brake" as used in this Order means the entire hand brake apparatus, including the foundation and brake rigging.

The term "efficient Hand Brake" as used in this Order means a hand brake by means of which a car can be stopped and held at any required point; requirement of an efficient hand brake includes the maintenance in operative condition of all hand-brake apparatus, including foundation brake rigging.

Additional Appliances. If any safety appliance equipment in addition to that specified in the Order is applied, such equipment must be properly maintained. For example, the end sill step on a Canadian car, if missing, would not be a defect, inasmuch as the law of this country does not require it, but if broken or loose it would be a defect.

*"A" and "B"
End of Cars.*

The end of car towards which the cylinder push rod travels shall be known as B end, and the opposite as A end. Handbrake (when only one applied) is usually located at B end.

On some cars there are two independent brakes, resulting in a push rod traveling towards each end. Under such circumstances there is no means of defining A or B end, and it is entirely within the jurisdiction of the manufacturer or owner to designate the ends, by marking them, or by stencilling the journal boxes. Should such a car be repaired the one handling it may stencil one end of the car, and make out the bill for repairs in accordance with his own marking.

Facing the B end of car, in their order on right side of car, wheels journal boxes and contained parts, shall be known as R1, R2, R3, R4, etc., and similarly on the left side of car shall be known as L1, L2, L3, L4, etc.

*Side or End
of Car.*

In measuring distances for location of Safety Appliances, the "side" or "end" of a car is the outside of that portion of superstructure which carries the load, i.e., outside of end or side planks on gondolas, outside of side or end sheathing of box cars, outside of side and end slats of stock cars.

*Right and Left Side
of Locomotives.*

On locomotives, standing at rear of tender or locomotive, on left is known as Left Side and on right as Right Side.

*Safety Appliance
terms "Right"
and "Left."*

In referring to Safety Appliances, "right" or "left" refers to side of person when facing end or side of car from ground.

Lateral Brace.

Lateral Brace is not required on sill steps of ordinary freight cars, whether over 18" in depth or not, but is required on tank cars without end sills and passenger cars without end platforms, or under side doors of baggage cars.

"Securely Fastened."

A sill step fastened to car with only one 1½" bolt on each side would hardly be considered securely fastened, on account of element of leverage entering into consideration. (There should preferably be two on each side.)

Section I.

Sub-Para. (VIII) FREIGHT CAR SAFETY APPLIANCE REQUIREMENTS **Requirements Common to All Freight Cars. (With exceptions as noted)**

[Excerpts of A. R. A. Rules.

Rule 2 para. A.—Cars (whether loaded or empty) having defects in violation of the Safety Appliance Acts should not be offered in interchange.

Rule 3 para. K—No car will be accepted in interchange unless properly equipped with United States Safety Appliances or United States Safety Appliances Standard.

[Excerpt of Court Decision: U. S. vs. S. P. 167, Fed. 699.

"A railroad company is under no obligation to receive from any other company cars defective as to Safety Appliances, and when it does receive cars from another company at any point it must know at its peril that each car so received is equipped with the Safety Appliances required by law, and that such appliances are in good order and condition."]

Hand Brakes

Number.

Each car shall be equipped with an efficient hand brake which shall operate in harmony with the power brake thereon. The hand brake may be of any efficient design, but must provide for the same degree of safety as the design shown on Plate A.

Dimensions

The brake shaft shall be not less than 1-1/4" in diameter, of wrought iron or steel without weld. The brake wheel may be flat or dished, not less than 15" preferably 16" in diameter, of malleable iron, wrought iron or steel. (Figure eight brake wheels are not allowed.) The use of a bar instead of a brake wheel is not permitted. The use of a ratchet-lever instead of a brake wheel is permitted.

Location.

The hand brake shaft shall be in such a position that it can be safely operated while car is in motion. The brake shall be located according to the specification for each type of car. (Box and other house cars not less than 17" nor more than 22" to the left of center line of car; fixed end gondolas not more than 22" to the left of center line of car; drop end gondolas on end of car to the left of center line; flat cars on end of car to left of center line or on side of car not more than 36" from right end thereof.)

Manner of Application.

There shall be not less than 4" radial clearance around rim of brake wheel. Outside edge of brake wheel shall be not less than 4" from a vertical plane parallel with end of car and passing through the inside face of knuckle when closed, with coupler horn against the buffer block or end sill. If brake ratchet-wheel is more than 36" from brake wheel, a brake shaft support shall be provided to support this extended upper portion of brake shaft; (This support may be omitted on high side gondola and hopper cars with drop ends, if necessary.) Said brake shaft support shall be fastened with not less than 1/2" bolts or rivets. This support should not have a cutting edge, but preferably shall have an actual vertical bearing surface of at least 1/2"—preferably more. The bottom brake shaft support—when used—should have an actual vertical bearing surface of at least 3/4"—preferably more. (See Plate A) A brake shaft step shall support the lower end of brake shaft. A brake shaft step which will permit the brake chain to drop under the brake shaft shall not be used. U-shaped form of brake shaft step is preferred, and this brake shaft step should be quite free from any appliances whatever, such as retainer pipes, grab irons, etc. (See Plate A) Brake shaft shall be arranged with a square fit at its upper end to secure the hand brake wheel; said square fit shall be not less than 7/8 of an inch at its smallest point. Square fit taper, not less than 2 in 12 inches. (See Plate A).

Brake chain shall be of not less than $\frac{3}{8}$, preferably $\frac{7}{16}$ inch, wrought iron or steel, with a link on the brake rod end of not less than $\frac{7}{16}$, preferably $\frac{1}{2}$ inch wrought iron or steel, and shall be secured to brake shaft drum by not less than $\frac{1}{2}$ inch hexagon or square headed bolt. (Rectangular head of not less than $\frac{1}{2}$ " width is permissible) Eye bolts or round headed bolts are not permitted. Nut on said bolt shall be secured by riveting end of bolt over nut. (See Plate A) Lower end of brake shaft shall be provided with a trunnion of not less than $\frac{3}{4}$, preferably 1 inch in diameter extending through brake shaft step and held in operating position by a suitable cotter or ring. (Ring is preferred.) (See Plate A.) Brake shaft drum shall be not less than 1- $\frac{1}{2}$ inches in diameter. (A sleeve is not permitted to be used for the purpose of securing the 1- $\frac{1}{2}$ " diameter required). (See Plate A). Brake ratchet wheel shall be secured to brake shaft by a key or square fit, said square fit shall be not less than 1- $\frac{5}{8}$ inches square. When ratchet wheel with square fit is used (this type preferred) provision shall be made to prevent ratchet-wheel from rising on shaft to disengage brake pawl. (See Plate A) Brake ratchet wheel shall be not less than 5- $\frac{1}{4}$, preferably 5- $\frac{1}{2}$ inches in diameter and shall have not less than 14, preferably 16 teeth. (See Plate A) The hub of brake ratchet wheel preferably should be not less than 2" in depth. (See Plate A). The brake pawl shall be pivoted upon a bolt (nut preferably at top) or rivet not less than $\frac{5}{8}$ of an inch in diameter, or upon a trunnion secured by not less than $\frac{1}{2}$ inch bolt or rivet, and there shall be a rigid metal connection between brake shaft and pivot of pawl. (Metal end sill or metal brake step board will fill requirement of rigid metal connection, provided there is no slack.) Brake wheel shall be held in position on brake shaft by a nut on a threaded extended end of brake shaft; said threaded portion shall be not less than $\frac{3}{4}$ of an inch in diameter; said nut shall be secured by riveting over or by the use of a lock nut or suitable cotter. (Rivetting over without the use of a nut, or the use of a washer only, is not permitted.) Brake wheel shall be arranged with a square fit for brake shaft in hub of said wheel; taper of said fit, not less than 2 in 12 inches (See Plate A.).

Note (i) Short brake staffs are permitted on logging flats, provided 4" brake wheel clearance is maintained.

Note (ii) Brake wheels with offsets for convenience, may be used, even though they are neither flat nor dished.

Note (iii) In measuring to decide whether a brake staff requires a top support, height is measured from top of ratchet wheel to bottom of brake wheel.

Note (iv) Handbrakes are defective when they cannot be operated while car is in motion. This includes drop or folding type brake shaft when in a lay-down or dropped position, *but not ratchet lever*.

Note (v) Brake staffs, equipped with mesh gears for operating brakedrum or foundation brake rigging, are permissible, if the same degree of safety and efficiency is obtained.

Foundation Brake Rigging

Brake beams will be applied in accordance with A. R. A. standards, but outside-hung brake beams from body of car must be provided with two guides or finger guards, securely fastened to beam, and should have not more than 1 $\frac{1}{2}$ " (preferably 1") clearance between guard or guide, and back of flange of wheel. Hand-brake rod must have loop of brake chain end turned

upward so chain will not fall off, and where chains are on both ends of rod both loops must be closed.

Brake Step

If brake step is used, it shall be not less than 28" in length. Inside edge should be 1" from face of car, and outside edge shall be not less than 8" from face of car and not less than 4" from a vertical plane parallel with end of car passing through the inside face of knuckle when closed with coupler horn against the buffer block or end sill.

Manner of Application. Brake step shall be supported by not less than two metal braces having a minimum cross sectional area of $\frac{3}{8}$ " by $1\frac{1}{2}$ ", or equivalent, which shall be securely fastened to body of car with not less than $\frac{1}{2}$ " bolts or rivets. Triangular braces are preferred.

Sill Steps

(See tank car specifications for sill steps.)

Number — Four.

Dimensions. Minimum cross-sectional area, if flat $\frac{1}{2}$ " by $1\frac{1}{2}$ ", or if round 1", of wrought iron or steel. Should round iron or steel be used the flattened portion by which it is fixed to car must be at least $\frac{1}{2}$ " thick, with enough width to obtain minimum cross-sectional area ($=\frac{3}{4}$ sq. in.). Minimum length of tread, 10", preferably 12". Minimum clear depth, 8". Minimum horizontal clearance preferably 5", measured from outside edge of sill step towards longitudinal center line of car, for full length and minimum clear depth; if more than one tread is used the same clearance requirements shall apply to each tread.

Location One near each end on each side of car under side ladders and side handholds, preferably located so that tread of sill step shall not project beyond vertical lines passing thru ends of ladder treads or handholds. In no case must center of tread of sill step exceed 18" from end of car. (In case of platform end sill cars, measure from end of car body proper.) Outside edge of tread of step shall be not more than 4" inside face of side of car, preferably flush with side of car. Tread shall be not more than 24", preferably not more than 19" above the top of rail.

Manner of Application Sill steps *under ladders* exceeding 21" in depth shall have an additional tread. Additional treads not required except under ladders. Sill steps shall be securely fastened with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) When *applying*, sill steps should be made of not less than $\frac{1}{2}$ " inch flat iron, on account of strain being against thickness. (Cars are not to be bad ordered or refused in interchange if $\frac{3}{8}$ " x 2" steps exist.)

Note (ii) There is no minimum height above rail for sill steps, but they should never be set lower than 17".

Side Handholds

(Applicable to all cars excepting flats and tank cars)

(For cabooses, see Caboose Specifications.)

Number Four or more (Tread of side ladder is a side handhold.)

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel.
Minimum clear length, 16", preferably 24". Maximum length preferably not more than 36". Minimum clearance, 2", preferably $2\frac{1}{2}$ ".

Location Horizontal; One near each end on each side of car.
Not less than 24", nor more than 30" above center line of coupler, *except* as provided above, where tread of ladder is a handhold. If an additional handhold is applied over sill step on left end of side of car, it should (preferably) be not less than 42" nor more than 48" above center line of coupler. Clearance of outer end of handhold shall be not more than 8" from end of car.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) If a car is of such construction that sides are less than 24" above center line of coupler, but more than 12", the horizontal hand holds must be placed as near to top as possible, but not projecting above top.

Note (ii) If a car is temporarily built up on sides and ends, in order to carry a special load, side handholds must be provided as if the car were permanently of the extra height.

Couplers

Number Two.

Location One on each end of car.

Manner of Application Each car shall be equipped with couplers coupling automatically by impact, and which can be coupled and uncoupled, without the necessity of men going between

the ends of the cars. Each coupler shall be attached to car in a safe and secure manner.

Height of Couplers Prescribed standard height of drawbars: Standard gauge railroads, *maximum* $34\frac{1}{2}$, *minimum* $31\frac{1}{2}$ inches; narrow gauge railroads, maximum 26, minimum 23 inches; 2' gauge railroads, maximum $17\frac{1}{2}$, minimum $14\frac{1}{2}$ inches; measured from level of tops of rail to center line of coupler.

Note (i) In case of couplers with offset heads, measure from center of coupler head. (This is preferable point of measurement with all couplers.)

Uncoupling Levers

(Note remarks under Tank Cars without end sills).

Number. Two, which may be either single or double, Uncoupling lever may be of any design which affords the same degree of safety, efficiency, and facility of operation as the design shown on Plate B.

Dimensions. Handles of all uncoupling levers, *except* those with rotating levers, (as shown on Plate B) shall be not more than 6" from sides of car. Uncoupling levers of rotating type, as shown on plate B, shall conform to the following prescribed limits: Handles shall be not more than 12", preferably 9" from sides of cars. Center lift arms of top lift type shall be not less than 7" long, measured from center of rotating rod to center of eye. Center of eye at end of center lift arm shall be not more than 3½" beyond center of eye of uncoupling pin of coupler when horn of coupler is against the buffer block or end sill. (See Plate B.) Ends of handles shall extend not less than 4" below bottom of end sill, or shall be so constructed as to give a minimum clearance of 2" around handle for at least 4" at its gripping end. Minimum drop of handles, shall be 12", maximum 15" over all (measured from top of rotating member). (See Plate B.) Handles of uncoupling levers of the "rocking" or "push down" type shall be not less than 18" from top of rail when lock-block has released knuckle, and a suitable stop shall be provided to prevent inside arm from flying up in case of breakage. A lever of this type shall be so applied as to provide a minimum clearance of 2" around handle for at least 4" (preferably 6") from end of handle. A side pull uncoupling lever requires a gripping area of 4" (minimum) only, and where levers with long handles have been applied they must be cut off, as they represent a waste of material and serve no useful purpose. In cutting these off our standard length to cut them is 5" from under side of main rod. Uncoupling levers may be made of any shaped material, round, hexagon, etc.

Location One on each end of car. When single lever is used, it shall be placed on left side of end of car.

Manner of Application When uncoupling lever castings are renewed or applied, they shall be fastened with bolts. The A. R. A. rules require that cars built on and after January 1st, 1919 must be equipped with direct connection from uncoupling lever to lock lift without the use of links, clevises, clevis pins, or chains.

Note:—Uncoupling lever handles should not lay over end sill handholds, even with clearance from same, as this obstructs the use of the hand hold.

End Ladder Clearance

(Applicable to all cars excepting flat cars).

No part of car above end sills within 30" from side of car, except buffer block, brake shaft, brake wheel, brake step, running board or uncoupling lever shall extend to within 12" of a vertical plane parallel with end of car and passing through inside face of knuckle when closed with coupler horn against buffer block or end sill, and no part of end of car or fixtures on same above end sills, other than exceptions herein noted, shall extend beyond outer face of buffer block.

Note (i) On cars built prior to July 1st, 1911, no change need be made to secure additional end ladder clearance (provided 10" clearance exists) excepting when car is rebuilt.

Note (ii) Brake step is excepted from interfering with end ladder clearance, providing it is placed in such a position on car as not to foul the end ladder.

Note (iii) The proper method of ascertaining end ladder clearance on a car is:—

- (a) Measure distance from inside face of knuckle when closed, to back of horn of coupler, ascertaining whether it be $9\frac{1}{4}$ ", 12", or $12\frac{1}{4}$ " head.
- (b) Measure distance from end sheathing to face of buffer block.
- (c) Measure distance from end sheathing to outside edge of ladder tread.

Add (a) plus (b) subtract (c). The result is end ladder clearance, provided no obstructions other than those excepted exist. If there are any, they will be further deducted. When end brace rods are used, measure 30" from side of car on rod and take distance it is from end sheathing at this point, for figure (c).

Horizontal End Handholds

(Applicable to all cars excepting flat cars, drop end gondolas and tank cars,) but end sill grab irons are required on these cars also.

Number Eight or more. Four or more on each end of car.
(Tread of end ladder is an end handhold).

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel.
Minimum clear length, 16", preferably 24". A handhold 14" in length may be used where it is impossible to use 16" in length.
Minimum clearance, 2", preferably $2\frac{1}{2}$ ".

Location One near each side on each end of car, not less than 24" nor more than 30" above center line of coupler, except as provided above, when tread of end ladder is an end handhold. Clearance of outer end of handhold shall be not more than 8" from side of car. One near each side of each end of car on *face* of end sill or sheathing over endsill, projecting outward or downward. Clearance of outer end of handhold shall be not more than 16" from side of car. On each end of car with platform end sills 6" or more in width, measured from end of car and extending entirely across end of car, or 6" or more in width at longitudinal centerline of car and tapered to not less than 4" in width at side of car, there shall be one additional end handhold not less than 24" in length, located near center of car, not less than 30" nor more than 60" above platform end sill.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) Bottom tread of end ladder may be used as end sill grab, provided it is not more than 8" from side of car, and has required offset.

Note (ii) End sill handholds must not be applied to top of top flange or bottom of bottom flange of end sill channels. The "face" of end sill channels constitutes the vertical section and the inside of flanges only.

Note (iii) Tread of end ladder is an end handhold and does not have to be within the prescribed 24" and 30" limit above center line of coupler.

Note (iv) If a car is of such construction that sides are less than 24" above center line of coupler. but more than 12", the horizontal handholds must be placed as near to top as possible, but not projecting above top.

Vertical End Handholds

(Applicable to all cars with 6" end sill platforms, excepting drop end gate gondolas and Low side Gondolas).

<i>Number</i>	Two on platform end sill car, as above described.
<i>Dimensions</i>	Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 18", preferably 24". Minimum clearance, 2", preferably $2\frac{1}{2}$ ".
<i>Location</i>	One on each end of car opposite ladder, not more than 8" from side of car; clearance of bottom end of handhold shall be not less than 24" nor more than 30" above center line of coupler.
<i>Manner of Application</i>	Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Retaining Valves

Air-brake pressure retaining valve should be securely fastened to car in a vertical position, preferably with bolts, and preferably located so that it can be safely operated by a man in the position occupied when operating the hand brake.

Box and Other House Cars

(See requirements common to all freight cars.)

Running Boards

<i>Number</i>	One longitudinal running board. On outside metal roof cars, two latitudinal extensions.
<i>Dimensions</i>	Longitudinal running board shall be not less than 18", preferably 20" in width. Latitudinal extensions shall be not less than 24" in width.
<i>Location</i>	Full length of car, center of roof. On outside metal roof cars there shall be two latitudinal extensions from longitudinal running board to ladder locations, except on refrigerator cars where such latitudinal extensions cannot be applied on account of ice hatches.
<i>Manner of Application</i>	Running board shall be made of wood, continuous from end to end, not cut, hinged or obstructed at any point, and securely fastened with screws or bolts to saddle blocks which shall be securely fastened, preferably bolted, to car; provided, that the length and width of running board may be made up of a number of pieces. (No exceptions are taken to running boards consisting of short pieces placed laterally).

The ends of running board shall be not less than 6" nor more than 10" from a vertical plane parallel with end of car and passing through inside face of knuckle when closed with coupler horn against buffer block or end sill and if more than 4" from edge of roof of car, shall be securely supported their full width by substantial metal braces. (No size specified but preferably $\frac{3}{8}$ "x $1\frac{1}{2}$ ").

Latitudinal extension of running board, when used, shall be made of wood and securely fastened with screws or bolts to saddle blocks which shall be securely fastened, preferably bolted, to car and running boards or saddles.

Ladders

Number Four.

Dimensions Minimum clear length of tread: Side ladders, 16"; end ladders, 14". Maximum spacing between treads, 19". (From top of one tread to top of the other). Spacing of side ladder treads shall be uniform within a limit of 2" from top tread to bottom tread. Maximum distance from bottom tread of side ladder to top tread of sill step, 21". End ladder treads shall be spaced to coincide with treads of side ladders, a variation of 2" being allowed. Where construction of car does not permit the application of a tread of end ladder to coincide with bottom tread of side ladder, bottom tread of end ladder shall coincide with second tread from bottom of side ladder.

Hard wood treads, minimum dimensions, 1½" by 2". Iron or steel treads, minimum diameter, 5/8". Minimum clearance of treads, 2", preferably 2½".

Location One on each side, not more than 8" from right end of car, one on each end, not more than 8" from left side of car; measured from inside edge of ladder stile or clearance of treads to corner of car.

Top tread shall be located not less than 12" nor more than 18" from roof at eaves.

Note (i) Cars with swinging end doors must have end ladders which should be placed as near as possible to designated location.

Manner of Application Metal ladder without stiles shall have foot guard or upward projection not less than 2" in height as near as possible to the inside end of bottom tread.

When bottom tread of end ladder is so located that it coincides with second tread of side ladder, second tread of side ladder should also have similar foot guard or upward projection. (Applicable to new cars and cars being rebuilt or when these appliances are renewed.)

The construction of metal ladder, without stiles, with each tread having foot guards or upward projections not less than 2" in height near both ends is preferred, although not required. Stiles of ladders, projecting 2" or more from face of car, serve as foot guards. Ladder shall be securely fastened to car. Metal ladder without stiles shall have treads fastened to car with not less than ½" bolts, with nuts outside when possible and riveted over, or with not less than ½" rivets. Ladder with stiles shall have stiles fastened to car and treads fastened to stiles with not less than ½" bolts, with nuts outside when possible and riveted over, or with not less than ½" rivets; provided that any other form of fastening may be used for securing stiles to car and ladder treads to stiles if it affords the same degree of safety. 3/8" bolts may be used to fasten wooden treads which are gained into stiles. (Bottom treads of ladders must have offsets where treads are fastened to stiles but are not flush with stile, protruding out as in ordinary application.)

Roof Handholds

Number One over each ladder. One right angle handhold may take the place of two adjacent roof handholds; provided dimensions and locations coincide, and an extra leg is securely fastened to car at point of angle.

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length 16". Minimum clearance 2", preferably $2\frac{1}{2}$ ".

Location On roof of car; One parallel to treads of each ladder, not less than 8" nor more than 15" from edge of roof, except on refrigerator cars where ice hatches prevent, when location may be nearer edge of roof.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets. Roof handhold shall not be fastened to side or end of car.

Additional Roof Handholds (Preferred only)

(On refrigerator or ventilator car having ice hatch, hood or other similar arrangement located on top of car above ladders, the top of which is 10" or more above roof).

Number One over each ladder. One right angle handhold may take the place of two adjacent roof handholds, provided dimensions and locations coincide, and an extra leg is securely fastened at point of angle.

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 12". Minimum clearance 2", preferably $2\frac{1}{2}$ ".

Location On hatch, hood, or other similar arrangement; one parallel to treads of each ladder, not more than 6" from outside edge of hatch, hood, or other similar arrangement.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets. Said hatch, hood or other similar arrangement on which roof handholds are located shall be securely fastened whether open or closed.

Hopper Cars and High Side Gondolas with Fixed Ends

(See requirements common to all freight cars).

Handbrakes

In accordance with specification for all freight cars, excepting that hand-brake staff will be located on the end of car, and to the left of, not more than 22" from center, (no minimum).

Ladders

Same as box and other house cars, excepting that top ladder tread shall be located not more than 4" from top of car.

Drop-End High-Side Gondola Cars

(See requirements common to all freight cars).

Handbrakes

Same as specified for all Freight cars, excepting that brake shaft must be located on end of car, to left of center, but no minimum nor maximum distance is specified. Where brake wheel and ratchet wheel are more than 36" apart, the brake shaft support may be omitted, if necessary, because of the drop end.

Ladders

Same as box and other house cars, excepting that top ladder tread shall be located not more than 4" from top of car, and only side ladders are necessary.

Horizontal End Handholds

Number Four.
Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel.
 Minimum clear length, 16", preferably 24". A handhold 14" in length may be used where it is impossible to use 16" in length. Minimum clearance, 2", preferably $2\frac{1}{2}$ ".
Location One near each side of each end of car, on face of end sill. Clearance of outer end of hand-hold shall be not more than 16" from side of car.
Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) End sill handholds must not be applied to top of top flange or bottom of bottom flange of end sill channels. The "face" of end sill channels constitutes the vertical section and the inside of flanges only.

Fixed-End Low-Side Gondola and Low-Side Hopper Cars

(See requirements common to all freight cars).

Handbrakes

Same as specified for all Freight Cars, excepting that brake shaft must be located on end of car, to the left of, but not more than 22" from center, (no minimum).

Drop-End Low-Side Gondola Cars

(See requirements common to all freight cars).

Handbrakes

Same as specified for all Freight Cars, excepting that brake shaft must be located on end of car, to left of center, but no minimum or maximum distance is specified.

Horizontal End Handholds

Number Four.
Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel.
 Minimum clear length, 16", preferably 24". A handhold 14" in length may be used where it is impossible to use 16" in length. Minimum clearance, 2", preferably $2\frac{1}{2}$ ".
Location One near each side of each end of car, on face of end sill. Clearance of outer end of hand-hold shall be not more than 16" from side of car.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) End sill handholds must not be applied to top of top flange or bottom of bottom flange of end sill channels. The "face" of end sill channels constitutes the vertical section and the inside of flanges only.

Flat Cars

(This includes cars with sides or ends 12" or less above floor).

(See requirements common to all freight cars)

Handbrakes

The same as specified for all Freight Cars, excepting that brake staff shall be located on end of car to left of center, or on side of car, not more than 36" from right hand end thereof.

Horizontal End Handholds

Number Four.
Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 16", preferably 24". A handhold 14" in length may be used where it is impossible to use 16" in length. Minimum clearance, 2", preferably $2\frac{1}{2}$ ".

Location One near each side of each end of car, on face of end sill. Clearance of outer end of hand-hold shall be not more than 16" from side of car.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) End sill handholds must not be applied to top of top flange or bottom of bottom flange of end sill channels. The "face" of end sill channels constitutes the vertical section and the inside of flanges only.

Side Handholds

Number Four.
Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 16", preferably 24". Maximum length preferably not more than 36". Minimum clearance, 2", preferably $2\frac{1}{2}$ ".

Location One on face of each side sill near each end. Clearance of outer end of handhold shall be not more than 12" from end of car.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Tank Cars with Side Platforms

(See requirements common to all freight cars).

Handbrakes

Same as specified for all Freight Cars, excepting that brake shaft must

be located on end of car, to left of center, but no minimum nor maximum distance is specified.

Sill Steps

Number Four.
Dimensions Minimum cross-sectional area, if flat $\frac{1}{2}$ " by $1\frac{1}{2}$ ", or if round 1", of wrought iron or steel. Should round iron or steel be used the flattened portion by which it is fixed to car should be at least $\frac{1}{2}$ " thick, with enough width to obtain minimum cross-sectional area ($=\frac{3}{4}$ sq. in.). Minimum length of tread 10", preferably 12". Minimum clear depth, 8". Minimum horizontal clearance preferably 5" measured from outside edge of sill step towards longitudinal center line of car, for full length and minimum clear depth; if more than one tread is used the same clearance requirements shall apply to each tread.

Location One as near as possible to each end on each side of car under side handholds, preferably located so that tread of sill step shall not project beyond vertical lines passing thru ends of handholds. In no case must center of tread of sill steps exceed 18" from end of car, (outside face of end sill). Outside edge of tread of step shall be not more than 4" inside of face of side of car, preferably flush with side of car. Tread shall be not more than 24", preferably not more than 19" above the top of rail.

Manner of Application Sill steps shall be securely fastened with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) When *applying*, sill steps should not be made of less than $\frac{1}{2}$ " thick flat iron, on account of strain being against thickness. (Cars are not to be bad ordered or refused in interchange if $\frac{3}{8}$ " x 2" steps exist.)

Note (ii) There is no minimum height above rail for sill steps, but they should not be set lower than 17".

Side Handholds

Number Four or more.
Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 16", preferably 24". Maximum length not more than 36". Minimum clearance, 2", preferably $2\frac{1}{2}$ ".

Location Horizontal: One on face of each side sill near each end. Clearance of outer end of handhold shall be not more than 12" from end of car.

If side safety railings are attached to tank or tank bands, four additional vertical handholds shall be applied, one over each horizontal handhold and sill step, securely fastened to tank side or end, or tank band.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and rivetted over, or with not less than $\frac{1}{2}$ " rivets.

Same as specified for "Box and other house cars," provided that handhold may be fastened to suitable lugs or brackets that are rigidly secured to tank body.

Horizontal End Handholds

<i>Number</i>	Four.
<i>Dimensions</i>	Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 16", preferably 24". A handhold 14" in length may be used where it is impossible to use 16" in length. Minimum clearance, 2", preferably $2\frac{1}{2}$ ".
<i>Location</i>	Horizontal: One near each side of each end of car on face of end sill. Clearance of outer end of handhold shall be no more than 16" from side of car.

<i>Manner of Application</i>	Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets.
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Tank Head Handholds

<i>Number</i>	Two (Not required if safety railing runs around end of tank).
<i>Dimensions</i>	Minimum diameter $\frac{5}{8}$ ", wrought iron or steel. Minimum clearance 2", preferably $2\frac{1}{2}$ ". Clear length of handholds shall extend to within 6" of outer diameter of tank.
<i>Location</i>	Horizontal: one across each head of tank, not less than 30" nor more than 60" above platform.
<i>Manner of Application</i>	Securely fastened with bolts or rivets; handhold may be fastened to suitable lugs or brackets that are rigidly secured to tank body at side or end.

Hand Rails

<i>Number</i>	One continuous hand rail around sides and ends of tank, securely fastened to tank, lug, bracket, or tank bands at ends and sides of tank; or two extending full length of tank at sides of car supported by posts.
<i>Dimensions</i>	Minimum diameter, $\frac{3}{4}$ " preferably $\frac{7}{8}$ ", or equivalent, wrought iron or steel. Minimum clearance between supports or fastenings, preferably $2\frac{1}{2}$ ".
<i>Location</i>	Full length of tank; at side supported by posts, or securely fastened to tank, lugs, brackets, or tank bands, not less than 30" nor more than 60" above platform.
<i>Manner of Application</i>	Securely fastened to tank body, lugs, brackets, tank bands or posts.

Dome Step (Preferably)

On tank car equipped with dome step; such step shall be not less than 7" in width and 28" in length; preferably length, equal to diameter of dome; supported by not less than two metal braces, having minimum cross sectional area of $\frac{3}{8}$ " by $1\frac{1}{2}$ " or equivalent, securely fastened.

There shall be a metal ladder of standard dimensions for a tank car, extending from running board to side handrail or dome step, securely fastened

at each end. If ladder does not extend above hand rail, handhold of standard dimensions for a tank car shall be applied to under face of dome step, flush with outer edge thereof.

A suitable metal handhold shall be applied to dome over step. Handhold shall be securely fastened.

Tank Cars without Side Sills and Tank Cars with Short Side Sill and End Platforms

(See requirements common to all freight cars).

Handbrakes

Same as specified for all Freight Cars, excepting that brake shaft must be located on end of car, to left of center, but no minimum nor maximum distance is specified.

Running Boards

Number One continuous running board around sides and ends or two extending full length of tank, one on each side.

Dimensions Minimum width on side 10". Minimum width on ends 6", preferably 10". Minimum thickness, 1½".

Location Continuous around sides and ends of cars. On tank cars having end platforms extending to bolsters, running board shall extend from center to center of bolsters, one on each side. Side running board applied below center line of tank shall be placed preferably on level with end sills or floor line of car.

Side running board applied below center line of tank shall extend not less than 7" beyond buldge of tank. Running board at end of car, applied above center line of tank preferably for a distance of 18" on each side of longitudinal center line of car, shall be not less than 6" nor more than 10" from a vertical plane perpendicular to longitudinal center line of car and passing through inside of knuckle when closed with coupler horn against buffer block, end sill or back stop.

Manner of Application Securely fastened to tank, lugs, brackets, tankbands or tank frame, and preferably supported to prevent sagging; where running board is spliced, joint shall be flush and both ends supported.

Sill Steps

Number Four.

Dimensions Minimum cross-sectional area, if flat ½" by 1½", or if round 1", of wrought iron or steel. Should round iron or steel be used the flattened portion by which it is fixed to car must be at least ½" thick, with enough width to obtain minimum cross-sectional area (≡¾ sq. in.). Minimum length of tread, 10", preferably 12". Minimum clear depth, 8". Minimum horizontal clearance 5" measured from outside edge of sill step towards longitudinal center line of car, for full length and minimum clear depth; if more than one tread is used the same clearance requirements shall apply to each tread.

Location One near each end on each side under side handhold. Outside edge of tread of step shall be not more than 4" inside of side of car, preferably flush with side of car.

Tread shall be not more than 24", preferably not more than 19" above the top of rail.

Manner of Application Sill steps exceeding 21" in depth shall have an additional tread. Sill steps shall be securely fastened with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Ladders

(If running boards are so located as to make ladders necessary).

Number Two on cars with continuous running boards. Four on cars with side running boards.

Dimensions Minimum clear length of tread 10". Maximum spacing of tread, 19". Hardwood treads, minimum dimensions $1\frac{1}{2}$ by 2" Wrought iron or steel treads, minimum diameter, $\frac{5}{8}$ ". Minimum clearance 2" preferably $2\frac{1}{2}$ ".

Location On cars with continuous running boards, one at right end of each side. On cars with side running boards, one at each end of each running board.

Manner of Application Ladders shall be securely fastened with not less than $\frac{1}{2}$ " bolts or rivets.

Side Handholds

Number Four or more.

Dimensions Minimum diameter $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length 16", preferably 24". Minimum clearance 2" preferably $2\frac{1}{2}$ ".

Location Horizontal: One on face of each side sill near each end on tank cars with short side sills, or one attached to top of running board projecting outward above sill steps or ladders on tank cars without side sills. Clearance of outer end of handhold shall be no more than 12" from end of car. If side safety railings are attached to tank or tank bands four additional vertical handholds shall be applied, one as nearly as possible over each sill step and securely fastened to tank or tank band.

Manner of Application Securely fastened with no less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Horizontal End Handholds

Number Four.

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 16", preferably 24". A handhold 14" in length may be used where it is impossible to use 16" in length. Minimum clearance, 2", preferably $2\frac{1}{2}$ ".

Location One near each side of each end of car, on face of end sill. Clearance of outer end of hand-hold shall be not more than 16" from side of car.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Tank Head Handholds

(Not required if safety railing runs around end of tank).

Number Two
Dimensions Minimum diameter $\frac{5}{8}$ ", wrought iron or steel. Minimum clearance 2", preferably $2\frac{1}{2}$ ". Clear length of handholds shall extend to within 6" of outer diameter of tank, at point of application.

Location Horizontal: one across each head of tank, not less than 30" nor more than 60" above platform.

Manner of Application Securely fastened with bolts or rivets; hand-hold may be fastened to suitable lugs or brackets that are rigidly secured to tank body at side or end.

Safety Railings

Number One around sides and ends of tank or two extending full length of tank.

Dimensions Minimum diameter, $\frac{7}{8}$ ", or equivalent, wrought iron or steel. Minimum clearance, between supports or fastenings $2\frac{1}{2}$ ".

Location Full length of tank, not less than 30" nor more than 60" above platform or running board.

Manner of Application Securely fastened to tank, lugs, brackets, or tank bands and secured against end shifting.

Dome Steps (Preferably)

On tank car equipped with dome step such step shall be not less than 7" in width and 28" in length; preferable length, equal to diameter of dome; supported by not less than two metal braces, having minimum cross sectional area of $\frac{3}{8}$ " by $1\frac{1}{2}$ " or equivalent, securely fastened.

There shall be a metal ladder of standard dimensions for a tank car, extending from running board to side handrail or dome step, securely fastened at each end. If ladder does not extend above hand rail, a hand-hold of standard dimensions for a tank car shall be applied to under face of dome step, flush with outer edge thereof.

A suitable metal hand hold shall be applied to dome over step. Hand-hold shall be securely fastened.

Tank Cars without End Sills

(See requirements common to all freight cars).

Handbrakes

Same as specified for all freight cars, excepting that brake shaft must be located on end of car, to left of center, but no minimum nor maximum distance is specified.

Running Boards

Number One
Dimensions Minimum width on side 10". Minimum width on ends, 6", preferably 10". Minimum thickness, preferably 1½".

Location Continuous around sides and ends of tank, preferably below center line of bulge of tank.

Running board applied below center line of bulge of tank shall be placed preferably on level with floor line of car. Running board applied below center line of tank shall extend not less than 7" beyond bulge of tank. Running board at end of car applied above center line of tank, for a distance of preferably 18" each side of longitudinal center line of car, shall be not less than 6" nor more than 10" from a vertical plane perpendicular to longitudinal center line of car and passing through inside face of knuckle when closed with coupler horn against buffer block or back stop.

Manner of Application Securely fastened to tank, lugs, brackets, tank bands, or tank frame, and supported to prevent sagging. Where running board is spliced, joint shall be flush and both ends supported.

Sill Steps

Number Four. (If tank has high running boards, making ladders necessary, sill steps must meet ladder requirements.)

Dimensions Minimum cross-sectional area, if flat ½" by 1½", or if round 1", of wrought iron or steel. Should round iron or steel be used the flattened portion by which it is fixed to car should be at least ½" thick, with enough width to obtain minimum cross-sectional area (=¾ sq. in.). Minimum length of tread, 10", preferably 12". Minimum clear depth, 8". Minimum horizontal clearance preferably 5" measured from outside edge of sill step towards longitudinal center line of car, for full length and minimum clear depth; if more than one tread is used the same clearance requirements shall apply to each tread.

Location One near each end on each side, flush with outside edge of running board as near end of car as practicable. Tread not more than 24", preferably not more than 19" above the top of rail.

Manner of Application Sill step exceeding 18" in depth shall have an additional tread and be laterally braced. Securely fastened with not less than ½" bolts with nuts outside (when possible) and riveted over, or with not less than ½" rivets.

Ladders

(If running board is so located as to make ladders necessary).

<i>Number</i>	Two.
<i>Dimensions</i>	Minimum clear length of tread, 10". Maximum spacing of treads, 19". Hard wood treads, minimum dimensions, 1½" by 2". Wrought iron or steel treads, minimum diameter 5/8". Minimum clearance, 2", preferably 2½".
<i>Location</i>	One at right end of each side.
<i>Manner of Application</i>	Securely fastened with not less than ½" bolts or rivets.

Side Handholds

<i>Number</i>	Four.
<i>Dimensions</i>	Minimum diameter, 5/8", wrought iron or steel. Minimum clear length, 16", preferably 24". Maximum length preferably not more than 36". Minimum clearance, 2", preferably 2½".
<i>Location</i>	Horizontal: One near each end on each side of car over sill step, on running board, not more than 2" back from outside edge of running board, projecting downward or outward.

Where such side handholds are more than 18" from end of car, an additional handhold shall be placed near each end on each side, not more than 30" above center line of coupler.

Clearance of outer end of handhold shall be not more than 12" from end of car.

If hand rails are on tank, four additional vertical handholds shall be applied, one over each sill step.

<i>Manner of Application</i>	Securely fastened with not less than ½" bolts, with nuts outside (when possible) and riveted over, or with not less than ½" rivets.
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Horizontal End Handholds

<i>Number</i>	Four.
<i>Dimensions</i>	Minimum diameter, 5/8", wrought iron or steel. Minimum clear length, 16", preferably 24". A handhold 14" in length may be used where it is impossible to use 16" in length. Minimum clearance, 2", preferably 2½".
<i>Location</i>	Horizontal: One near each side on each end of car on running board, not more than 2" back from edge of running board, projecting downward or outward; or on end of tank not more than 30" above center line of coupler.
<i>Manner of Application</i>	Securely fastened with not less than ½" bolts with nuts outside (when possible) and riveted over, or with not less than ½" rivets.

Safety Railings

<i>Number</i>	One.
<i>Dimensions</i>	Minimum diameter, 7/8", or equivalent, wrought iron or steel. Minimum clearance between supports or fastenings, 2½".

Location Safety railings shall be continuous around sides and ends of car not less than 30" nor more than 60" above running board.

Manner of Application Securely fastened to tank, lugs, brackets, or tank bands, and secured against end shifting.

Uncoupling Levers

Number Two, which may be either single or double.

Uncoupling lever may be of any design which affords the same degree of safety, efficiency, and facility of operation as the design shown on Plate B.

Dimensions Uncoupling levers shall preferably be not less than 42" in length, measured from center line of car to handle of lever. Top lift uncoupling levers as shown on plate B, shall conform to the following prescribed limits: Handles shall be not more than 12", preferably 9" from sides of cars. Center lift arms shall be not less than 7" long, measured from center of rotating rod to center of eye. Center of eye at end of center lift arm shall be not more than 3½" beyond center of eye of uncoupling pin of coupler when horn of coupler is against the buffer block. (See Plate B). Ends of handles shall extend not less than 4" below bottom of end sill, or shall be so constructed as to give a minimum clearance of 2" around handle for at least 4" at its gripping end. Minimum drop of handles, shall be 12", maximum 15" over all. (See Plate B). Handles of uncoupling levers of the "rocking" or push down" type shall be not less than 18" from top of rail when lock-block has released knuckle, and a suitable stop shall be provided to prevent inside arm from flying up in case of breakage. A lever of this type shall be so applied as to provide a minimum clearance of 2" around handle for preferably 6" from end of handle. A side pull uncoupling lever requires a gripping area of 4" (minimum) only, and where levers with long handles have been applied they must be cut off, as they represent a waste of material and serve no useful purpose. In cutting these off our standard length to cut them to is 5".

Location One on each end of car. When single lever is used, it shall be placed on left side of end of car. **Uncoupling** lever shall be not more than 30" above center line of coupler.

Manner of Application When uncoupling lever castings and keepers are renewed or applied, they shall not be fastened with lag screws. Cars built on and after January 1st, 1919 must be equipped with direct connection from uncoupling lever to lock lift without the use of links, clevises, clevis pins, or chains (A. R. A. requirement).

End Ladder Clearance

No part of car above buffer block within 30" from side of car, except brake shaft, brake shaft brackets, brake wheel or uncoupling lever shall extend to within 12" of a vertical plane parallel with end of car and passing through inside face of knuckle when closed with coupler horn against buffer block or back stop, and no part of end of car or fixtures on same,

above buffer block, other than exceptions herein noted shall extend beyond face of buffer block.

Dome Step (Preferably)

On tank car equipped with dome step, such step shall be not less than 7" in width and 28" in length, preferable length, equal to diameter of dome; supported by not less than two metal braces, having minimum cross sectional area of $\frac{3}{8}$ " by $1\frac{1}{2}$ " or equivalent, securely fastened.

There shall be a metal ladder of standard dimensions for a tank car, extending from running board to side handrail or dome step, securely fastened at each end. If ladder does not extend above hand rail, a handhold of standard dimensions for a tank car shall be applied to under face of dome step, flush with outer edge thereof.

A suitable metal handhold shall be applied to dome over step. Handhold shall be securely fastened.

Caboose Cars with Platforms

(See requirements common to all freight cars).

Handbrakes

Same as specified for all freight cars, excepting that brake shaft must be located on platform, to left of center, but no minimum nor maximum distance is specified.

Running Boards

Number One longitudinal running board. On outside metal roof cars, two latitudinal extensions.

Dimensions Longitudinal running board shall be not less than 18", preferably 20" in width. Latitudinal extensions shall be not less than 24" in width.

Location Full length of car, center of roof, (on caboose car with cupola, longitudinal running boards shall extend from cupola.) Outside metal roof car shall have latitudinal extensions leading to ladder locations.

Manner of Application Running board shall be made of wood, continuous from end to end, not cut, hinged or obstructed at any point, and securely fastened with screws or bolts to saddle blocks which shall be securely fastened to car; provided, that the length and width of running board may be made up of a number of pieces.

The ends of running board shall be not less than 6" nor more than 10" from a vertical plane parallel with end of car and passing through inside face of knuckle when closed with coupler horn against buffer block or end sill and if more than 4" from edge of roof of car, shall be securely supported their full width by substantial metal braces.

Latitudinal extension of running board, when used, shall be made of wood and securely fastened with screws or bolts to saddle blocks or brackets which shall be securely fastened to car. If roof hand hold is secured to section of latitudinal extension of running board, that section of

latitudinal extension shall be securely fastened, preferably bolted to saddle blocks, brackets, or running board.

Ladders

Number Two.
Dimensions (Any changes necessitated from present applications to be made when cars undergo heavy repairs, only).

Minimum clear preferable length of treads 14": maximum spacing between treads preferably not more than 19" from top of one to top of next tread. Spacing of treads should be uniform within a limit of 2" from top tread to bottom tread. Treads of iron or steel, $\frac{5}{8}$ " minimum, with clearance of 2" minimum, preferably $2\frac{1}{2}$ ". (The standard application will be metal stiles extending over roof—minimum extension of which is 12" preferably 14"—eliminating necessity for roof handholds. Blue prints covering each type of car are available upon application.)

Location One on each end of car, preferably to right of center.
Manner of Application Ladder with stiles shall have stiles fastened to car and treads fastened to stiles with not less than $\frac{1}{2}$ " bolts, with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets; provided that any other form of fastening may be used for securing stiles to car and ladder treads to stiles if it affords the same degree of safety.

Roof Handholds

Number One over each ladder. Where stiles of ladders extend 12" or more above roof, no other roof handholds are required.

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length 16". Minimum clearance 2", preferably $2\frac{1}{2}$ ".

Location On roof of caboose, in line with and parallel to treads of ladder, not less than 8" nor more than 15" from edge of roof.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets. Roof handhold shall not be fastened to side or end of car.

Cupola Handholds

Number One or more.
Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clearance between supports or fastenings, 2" preferably $2\frac{1}{2}$ ".

Location One continuous handhold extending around top of cupola not more than 3" from edge of cupola roof. Four right angle handholds, one at each corner, not less than 16" in clear length from point of angle, may take the place of the continuous handhold, if locations coincide.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Side Handholds

Number Four
Dimensions Minimum diameter, $\frac{5}{8}$ ", preferably $\frac{3}{4}$ " wrought iron or steel. Minimum clear length 36". Minimum clearance 2", preferably $2\frac{1}{2}$ ".

Location One near each end on each side of car, curving downward toward center of car from a point not less than 30" above platform to a point not more than 8" from bottom of car. Top end of handhold shall be not more than 8" from outside face of end sheathing.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) Curved handholds on sides of cabooses must have a clear length of 36". If studs are used in applying they must be fastened to lower side of such handholds and project downward so that there are two inches between handhold and side of caboose. Clearance of top end must be at least 30" above level of platform.

Horizontal End Handholds

Number Four.
Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 16", preferably 24". A handhold 14" in length may be used where it is impossible to use one 16" in length. Minimum clearance, 2", preferably $2\frac{1}{2}$ ".

Location Horizontal: One near each side of each end of car on face of platform end sill. Clearance of outer end of handhold shall be not more than 16" from end of platform end sill.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Note (i) End sill handholds must *not* be applied to top of top flange or bottom of bottom flange of end sill channels. The "face" of end sill channels constitutes the vertical section and the inside of flanges only.

End Platform Handholds

Number Four.
Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clearance between supports or fastenings, 2", preferably $2\frac{1}{2}$ ".

Location One right angle handhold on each side of each end extending horizontally from doorpost to corner of car at approximate height of platform rail, then downward to within 12" of bottom of car.

Manner of Application Securely fastened with bolts, screws or rivets.

Note (i) Inspectors will pass cars with end platform handholds applied with screws, provided they are secure, but under no circumstances are screws to be used when renewing or applying on repair tracks.

Caboose Platform Steps

<i>Number</i>	Four box steps.
<i>Dimensions</i>	Minimum length of tread, 12", preferably full width of caboose platform. Minimum width of tread 6", Minimum clear depth 6", preferably 8".
<i>Location</i>	One at each corner of caboose. Bottom tread of step shall be not more than 24", preferably not more than 19", above top of rail.
<i>Manner of Application</i>	Securely fastened, preferably with 1/2" bolts or rivets.

Platform Handrails (Preferably)

<i>Number</i>	Two.
<i>Dimensions</i>	Vertical sections shall be not less than 1" in diameter; horizontal sections, cross sectional area not less than 1/2" by 1 1/2", or equivalent, wrought iron or steel.
<i>Location</i>	One at outer end of each platform continuous from end to end of platform end sill, provided, that horizontal section may have an opening of not more than 24", which shall be provided with a suitable chain or guard, detachable at one end.

Top of rail shall be not less than 30" from top face of platform end sill, supported by preferably six vertical posts and securely fastened thereto.

<i>Manner of Application</i>	Vertical supports shall be securely fastened to platform end sill by bolts or rivets.
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Note (i) Changes involved from existing design, to be made only when cabooses are being built or rebuilt.

Caboose Cars without Platforms

(See requirements common to all freight cars).

Handbrakes

Same as specified for all Freight cars, excepting that brake shaft must be located on end of car, to left of center, but no minimum nor maximum distance is specified.

Running Boards

<i>Number</i>	One longitudinal running board. On outside metal roof cars, two latitudinal extensions.
<i>Dimensions</i>	Longitudinal running board shall be not less than 18", preferably 20", in width. Latitudinal extensions shall be not less than 24" in width.
<i>Location</i>	Full length of car, center of roof. (On caboose cars with cupolas, longitudinal, running boards shall extend from cupola.) Outside metal roof car shall have latitudinal extensions leading to ladder locations.

Manner of Application Running board shall be made of wood, continuous from end to end, not cut, hinged or obstructed at any point, (excepting cupola) and securely fastened with screws or bolts to saddle blocks which shall be securely fastened, preferably bolted to car; provided, that the length and width of running board may be made up of a number of pieces.

The ends of running board shall be not less than 6" nor more than 10" from a vertical plane parallel with end of car and passing through inside face of knuckle when closed with coupler horn against buffer block or end sill and if more than 4" from edge of roof of car, shall be securely supported their full width by substantial metal braces.

Latitudinal extension of running board, when used, shall be made of wood and securely fastened with screws or bolts to saddle blocks or brackets which shall be securely fastened to car. If roof hand hold is secured to section of latitudinal extension of running board, that section of latitudinal extension shall be securely fastened to saddle blocks, brackets, or running board.

Side Door Steps

Number Two (if caboose has side doors).

Dimensions Minimum length 5 feet. Minimum width 6". Minimum thickness of tread, 1½". Minimum height of back stop 3", preferably 6".

Location One under each side door, with top of tread not more than 24", preferably not more than 19" above top of rail.

Manner of Application Supported by two iron brackets having a minimum cross-sectional area 7/8" by 3" or equivalent, each of which shall be securely fastened to car by not less than two ¾" bolts.

Ladders

Number Four.

Dimensions Minimum clear length of tread: Side ladders, 16"; end ladders, 14". Maximum spacing between treads, 19". (From top of one tread to top of the other). Spacing of side ladder treads shall be uniform within a limit of 2" from top tread to bottom tread. Maximum distance from bottom tread of side ladder to top tread of sill step, 21". End ladder treads shall be spaced to coincide with treads of side ladders, a variation of 2" being allowed. Where construction of car does not permit the application of a tread of end ladder to coincide with bottom tread of side ladder, bottom tread of end ladder shall coincide with second tread from bottom of side ladder.

Hard wood treads, minimum dimensions, 1½" by 2". Iron or steel treads, minimum diameter, 5/8". Minimum clearance of treads, 2" preferably 2½".

Location End Ladders One on each end of car, not more than 8" from left side of car, measured from inside edge of ladder stile or clearance of treads, to the corner of car. Top tread shall be located not less than 12" nor more than 18" from roof at eaves.

Location Side Ladders (on cars with end doors) One on each side of car, not more than 8" from right end of car, measured from inside edge of ladder stile or clearance of treads to corner of car. Top tread shall be located not less than 12" nor more than 18" from roof at eaves.

Location Side Ladders (on cars with side doors) One on each side of car, located to the left of and not more than 8" from side of doors, measured from inside clearance of ladder treads.

Manner of application Metal ladder without stiles shall have foot guard or upward projection not less than 2" in height as near as possible to the inside end of bottom tread.

When bottom tread of end ladder is so located that it coincides with second tread of side ladder, second tread of side ladder shall also have similar foot guard or upward projection. { Applicable to new cars and cars being rebuilt or these appliances renewed. }

The construction of metal ladder, without stiles with each tread having foot guards or upward projections not less than 2" in height near both ends is preferred, but not absolutely required. Stiles of ladders, projecting 2" or more from face of car, serve as foot guards. Ladder shall be securely fastened to car. Metal ladder without stiles shall have treads fastened to car with not less than $\frac{1}{2}$ " bolts, with nuts outside when possible and riveted over, or with not less than $\frac{1}{2}$ " rivets. Ladder with stiles shall have stiles fastened to car and treads fastened to stiles with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets; provided than any other form of fastening may be used for securing stiles to car and ladder treads to stiles if it affords the same degree of safety. $\frac{3}{8}$ " bolts may be used to fasten wooden treads which are gained into stiles. (Bottom treads of ladders must have offsets where treads are fastened to stiles but are not flush with stile, protruding out as in ordinary application.)

Roof Handholds

Number One over each ladder. Where stiles of ladders extend 12" or more above roof, no other roof handholds are required.

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length 16". Minimum clearance 2", preferably $2\frac{1}{2}$ ".

Location On roof of caboose, in line with and parallel to treads of ladder, not less than 8" nor more than 15" from edge of roof.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets. Roof handhold shall not be fastened to side or end of car.

Cupola Handholds

<i>Number</i>	One or more.
<i>Dimensions.</i>	Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clearance between supports or fastenings, 2", preferably $2\frac{1}{2}$ ".
<i>Location</i>	One continuous handhold extending around top of cupola not more than 3" from edge of cupola roof. Four right angle handholds, one at each corner, not less than 16" in clear length from point of angle, may take the place of the continuous handhold, if locations coincide.
<i>Manner of Application</i>	Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside and riveted over or with not less than $\frac{1}{2}$ " rivets.

Side Handholds

<i>Number</i>	Four or more.
<i>Dimensions</i>	Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 16", preferably 24". Maximum length preferably not more than 36". Minimum clearance, 2", preferably $2\frac{1}{2}$ ".
<i>Location</i>	Horizontal: One near each end on each side of car, not less than 24" nor more than 30" above center line of coupler. If an additional handhold is applied over sill step it shall be not less than 42" nor more than 48" above center line of coupler. Clearance of outer end of handhold shall be not more than 8" from end of car.
<i>Manner of Application</i>	Securely fastened with not less than $\frac{1}{2}$ " bolts, with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Side Door Handholds

<i>Number</i>	Four: Two curved, two straight.
<i>Dimensions</i>	Minimum diameter, $\frac{5}{8}$ ", preferably $\frac{3}{4}$ " wrought iron or steel. Minimum clearance 2", preferably $2\frac{1}{2}$ ".
<i>Location</i>	One curved handhold shall be located at side of each door opposite ladder, extending from a point not less than 36" above bottom of car, curving away from door downward to a point not more than 6" above bottom of car. One vertical handhold shall be located at ladder side of each door, extending from a point not less than 36" above bottom of car to a point not more than 6" above level of bottom of door.
<i>Manner of Application</i>	Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Horizontal End Handholds

<i>Number</i>	Eight or more. Four or more on each end of car. Tread of end ladder is an end handhold.)
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Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length 16", preferably 24".

A handhold 14" in length may be used where it is impossible to use 16" in length. Minimum clearance 2", preferably $2\frac{1}{2}$ ".

Location For cars without end doors, without platform end sills. One near each side on each end of car, not less than 24" nor more than 30" above center line of coupler, except as provided above, when tread of end ladder is an end handhold. Clearance of outer end of handhold shall be not more than 8" from side of car. One near each side of each end of car on face of end sill or sheathing over end sill, projecting outward or downward. Clearance of outer end of handhold shall be not more than 16" from side of car.

For cars with end doors, without platform end sills. The same as above.

For cars with end doors, with platform end sills. The same as above,

For cars without end doors, with platform end sills. In addition to the above on each end of car with platform end sills 6" or more in width, measured from end of car and extending entirely across end of car, or 6" or more in width at longitudinal center line of car and tapered to not less than 4" in width at side of car, there shall be one additional end handhold not less than 24" in length, located near center of car, not less than 30" nor more than 60 inches above platform end sill.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside and riveted over or with not less than $\frac{1}{2}$ " rivets.

Vertical End Handholds

On platform end sill cars on each end of car, with or without end doors, there shall be a vertical end handhold as described in "Requirements common to all freight cars."

Special Memoranda On Freight Cars

1. Cars of construction not covered specifically in the foregoing sections, relative to handholds, sill steps, ladders, hand brakes, running boards, etc., may be considered as of special construction, but shall have as nearly as possible, the same complement of handholds, sill steps, ladders, handbrakes, running boards, etc., as are required for cars of the nearest approximate type.

2. Locomotives while equipped with snow plows or flangers are to be regarded as cars of special construction within the meaning of the order.

3. Gondola and ballast cars with swinging side doors at ladder locations may be considered as cars of special construction.

Ladders and handholds need not be applied to swinging side doors.

A side vertical handhold shall be placed on corner posts of such cars, as nearly as possible over sill step. Handhold must be $\frac{5}{8}$ " in diameter,

at least 16" preferably 18" inside clear length, and securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside and riveted over, or with not less than $\frac{1}{2}$ " rivets.

4. High-side gondola and ballast cars with end platform 18" or more in length may be considered as cars of special construction.

Ladders shall be placed on such cars as prescribed for high-side gondola and hopper cars, with sill step under ladder, or as nearly under ladder as car construction will permit. Ends and sides of cars to be equipped with handholds in the same manner as flat cars.

5. Automobile cars with swinging end doors come under the heading of cars of special construction, but the end ladders should be placed as nearly as possible to designated location.

6. High-side, drop-bottom ore cars of narrow construction are to be regarded as cars of special construction. On such cars offset sill steps may be applied where, owing to the construction of car, the standard sill step would foul the oil box and prevent the proper opening of the lid.

7. There is no distinction between passenger and freight cars, and handholds must, therefore be placed on the ends of passenger cars and cabooses. (Administration ruling No. 67.)

8. In measuring ladder tread, spacing of top tread shall be taken from eave of roof at side of car, whether latitudinal running board is used or not.

9. Air hoses are not to be regarded as fixtures, as that word is used in that part of the order relating to "End Ladder Clearance."

10. When any train is operated with power or train brakes, not less than 85% of the cars of such train shall have their brakes used and operated by the engineer of locomotive drawing such train, *and all power brake cars in every such train which are associated together with the 85 per cent shall have their brakes so used and operated.*

11. When inspecting live trains, cars in train yards, and particularly cars on repair tracks, care should be exercised to see that no part of car, trucks, foundation brake rigging, etc., other than the wheels themselves, is less than $2\frac{1}{2}$ " above top of rail. This applies to even cotters and split pins, and is an important safety feature, and a requirement of the A. R. A. Rules.

12. *Handling of Chained-up Cars.* The following rules governing the handling of chained-up cars must be strictly adhered to:

(a) Cars with defective or missing couplers must not be hauled by means of chains in a revenue train or in association with other cars that are commercially used, unless they are loaded with perishable freight or live stock, and then only to a point where repairs can be made.

Note (i) The terms "revenue trains" or "cars commercially used" mean not only loaded cars, but empty cars going to a certain place for loading.

Note (ii) A "point where repairs can be made" is one at which the particular repairs required on a car can ordinarily be made.

Note (iii) "Perishable" freight is any commodity requiring refrigeration by use of either ice, heat, or other agency.

(b) A chained-up car must not be hauled from one point at which repairs can be made, to another; nor past a point at which repairs can be made.

Note: The convenience of the railroad Company, on account of the bad order situation, shortage of material, etc., is not sufficient reason for hauling cars with defective safety appliances from one point at which repairs can be made, to another.

(c) A car having a coupler pulled out between stations may be hauled to the nearest available repair point on the back end of caboose, with good coupler next to caboose, but must not be hauled beyond a point at which repairs can be made, in that condition.

(d) Such a car having coupler pulled out between stations may be chained and hauled to the nearest *side-track* and set out.

(e) A so-called "bad order pick-up" train, containing no revenue cars, may operate between repair points and chain up such cars, bringing them to the nearest point at which repairs can be made. Such a "bad order pick up" train, however, would be required to have a minimum of 85% of its air brakes operative.

(f) The use of chains for additional safety between twin and triple loads is permitted, and uncoupling attachments may be disconnected in such cases. However, when car becomes empty the chains should be removed and uncoupling attachments must be connected up before the cars are again put in service. The use of chains on cars other than those mentioned, is prohibited in revenue trains, or in association with cars commercially used, and such cases are cause for violation suit to be brought by the Government.

13. On passenger train cars, used in freight or mixed train service, the uncoupling attachments shall be so applied that the coupler can be operated from left side of car.

14. The only condition under which a car of the classification calling for end ladders could operate without one, would be if it were quite impossible—owing to construction of car—to apply one.

15. Snowplows may be closed on plow end, and coupler removed. This applies to both regular snow plows and plows applied to cars.

16. A grab fouled by ice, snow, or fallen pieces of coal would not be a defect.

17. It is not permissible to extend handholds beyond corner of car to get required clear length.

18. To provide for usual inaccuracies of manufacturing and for wear, where sizes of metal are specified, a total variation of five (5) per cent below size given is permitted.

19. Where $\frac{5}{8}$ " grab irons (or any other size) are flattened at ends for punching of holes to take bolts, they will not be of original thickness. As long as the same cross-sectional area is available, this meets the intent of the law.

20. The Order of the Commission prohibits the welding of brake staffs only, but the A. R. A. Association also prohibits the welding of grab irons, sill steps, and uncoupling levers.

21. Stake pockets and other car appliances are secondary to Safety Appliances, as far as location is concerned.

Definitions

End of Car As used in this order, the term "end of car" means the outside surface of end sheathing; when applied to flat cars, tank cars with end sills or cars of similar construction, the "end of car" is the face of end sill; on tank cars without end sills, it is the outside edge of running board; when applied to gondola or hopper cars or cars of similar construction, it is a vertical plane passing through end face, or extreme point of end face, of the superstructure of car body above end sill, excluding outside end posts, reinforcing members or other similar projections.

Side of Car As used in this order, the term "side of car" means the outside surface of side sheathing; or if side sill projects beyond side sheathing, or if car has no side sheathing, it is a vertical plane passing through outside edge of side sill; on tank cars without side sills, it is the outside edge of running board.

Face of End Sill When channel or I beam is used for end-sill, with flanges projecting outward, the term "face of end sill" includes upper face of bottom flange and lower face of top flange in addition to vertical face of web.

Drop End The term "drop-end" as used in describing cars, applies to gondola cars with ends in form of doors, hinged to car, and held in upright position by hooks or latches, and which may be dropped to floor of car without removing bolts or tie-rods.

Hinged Running Boards It was once a practice on some refrigerator and stock cars to have hinged running boards to take care of icing and feeding. These are now forbidden.

Sub-Para. (IX) PASSENGER CAR SAFETY APPLIANCE REQUIREMENTS Requirements Common To All Passenger Cars

Handbrakes

Number Each car shall be equipped with an efficient hand-brake which shall operate in harmony with the power brake thereon. The handbrake may be of any efficient design but must be

capable of bringing car to a stop within a reasonable distance, as well as holding it stationary.

Dimensions If brake staff is employed it shall preferably be not less than $1\frac{1}{4}$ " in diameter, of wrought iron or steel without weld.

The brake wheel (if used) may be flat or dished, preferably not less than 15", in diameter, of malleable iron, wrought iron, or steel. Figure eight brake wheels are not allowed. The use of a bar instead of brake wheel is not permitted. The use of a ratchet lever instead of a brake wheel is permitted, and the length of the handbrake ratchet lever should preferably be not less than 20" from the center of the brake staff to the end of the handbrake ratchet lever. (If ratchet levers are less than 20" in length, they should be changed when car is shopped for repairs.)

Location The handbrake shall be in such a position that it can be safely operated while car is in motion. (A brake wheel placed inside of a baggage car, must be kept accessible.)

Manner of Application There should preferably be not less than 4" radial clearance around the rim of brake wheel. Outside edge of wheel should be not less than 4" from a vertical plane parallel with end of car and passing through the inside face of knuckle when closed, with coupler horn against the buffer block or end sill. When brake staff is used, it will be supported by a brake staff step, and will be of such design as not to permit chain to drop under end of brake staff. U shaped form of step is preferred, and this must be kept free of obstructions, such as grab irons, etc.—Any support of brake staff employed shall be securely fastened with preferably not less than $\frac{1}{2}$ " bolts or rivets, and is to be free of cutting edge, with a vertical bearing surface of preferably $\frac{1}{2}$ ". Brake staff should be arranged with a square fit at its upper end to secure the hand brake wheel; said square fit should be not less than $\frac{7}{8}$ " at its smallest point. Square fit taper, preferably not less than 2" in 12". (See Plate A). Brake chain should be of not less than $\frac{3}{8}$ ", preferably $\frac{7}{16}$ ", wrought iron or steel, with a link on the brake rod end of not less than $\frac{7}{16}$ ", preferably $\frac{1}{2}$ " wrought iron or steel, and should be secured to brake shaft drum by not less than $\frac{1}{2}$ " hexagon or square headed bolt. (Rectangular head of not less than $\frac{1}{2}$ " width is permissible.) (Eye bolts or round headed bolts should not be permitted.) Nut on said bolts should be secured by riveting end of bolt over nut. (See Plate A.) Lower end of brake shaft should be provided with a trunnion of not less than $\frac{3}{4}$ ", preferably 1" in diameter extending through brake shaft step and held in operating position by a suitable cotter or ring. (ring is preferred). (See Plate A). Brake shaft drum should be not less than $1\frac{1}{2}$ " in diameter. (A sleeve is not permitted to be used for the purpose of obtaining the $1\frac{1}{2}$ " diameter required). (See Plate A).

Brake ratchet wheel should be secured to brake shaft by a key or square fit, said square fit should be not less than $1\frac{5}{16}$ " square. When ratchet wheel

with square fit is used (this type preferred) provision shall be made to prevent ratchet-wheel from rising on shaft to disengage brake pawl. (See Plate A). Brake ratchet wheel should be not less than $5\frac{1}{4}$ inches, preferably $5\frac{1}{2}$ " in diameter and shall have not less than 14, preferably 16 teeth. (See Plate A). The hub of brake ratchet wheel should be not less than 2" in depth. (See Plate A). The brake pawl shall be pivoted upon a bolt (nut preferably at top) or rivet not less than $\frac{5}{8}$ " in diameter, or upon a trunnion secured by not less than $\frac{1}{2}$ " bolt or rivet, and there shall be a rigid metal connection between brake shaft and pivot of pawl. (End sill or metal brake step board will fill requirement if sufficiently rigid to allow no disengagement.) Brake wheel should be held in position on brake shaft by a nut on a threaded extended end of brake shaft; said threaded portion should be not less than $\frac{3}{4}$ " in diameter; said nut should be secured by riveting over or by the use of a lock nut or suitable cotter. (Riveting over without the use of a nut, or the use of a washer only, should not be permitted.) Brake wheel should be arranged with a squarefit for brake shaft in hub of said wheel; taper of said fit, not less than 2" in 12". (See Plate A).

Foundation Brake Rigging

Brake beams will be applied in accordance with M. C. B. standards, but outside-body-hung brake beams must be provided with two guides or finger guards, securely fastened to beam, and should not have more than $1\frac{1}{2}$ " (preferably 1") clearance between guard or guide, and back of flange of wheel. Handbrake rod should have loop on brake chain end turned upward so chain will not fall off, and where chains are on both ends of rod both loops must be closed.

End Handholds

<i>Number</i>	Four.
<i>Dimensions</i>	Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length 16". Minimum clearance 2", preferably $2\frac{1}{2}$ ". Handholds shall be flush with or project not more than 1" beyond vestibule face, or face of end sill.

<i>Location</i>	Horizontal. One near each side on each end of vestibule end sill, platform end sill, or face of end sill or sheathing—as the case may be, extending downward. Clearance of outer end of handhold shall be not more than 16" from side of vestibule or stub end cars, and not more than 16" from end of platform end sills on open end platform cars. <i>If end handholds are attached to sheathing they must be applied on the outside.</i> End handholds must not be fastened to brake staff stirrup.
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Note: When marker sockets or brackets are located so they cannot be conveniently reached from platforms, suitable steps and handholds shall be provided for men to reach such sockets or brackets.

<i>Manner of Application</i>	End handholds shall be securely fastened with $\frac{1}{2}$ " bolts or rivets.
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Couplers

<i>Number</i>	Two.
<i>Location</i>	One on each end of car.
<i>Manner of Application</i>	Each car shall be equipped with couplers, coupling automatically by impact, and which can be coupled and uncoupled, without the necessity of men going between the ends of cars. Each coupler shall be attached to car in a safe and secure manner.
<i>Height of Couplers</i>	Prescribed standard height of drawbars: Standard gauge railroads, <i>maximum</i> 34½, <i>minimum</i> 31½ inches; narrow gauge railroads, maximum 26, minimum 23 inches; 2' gauge railroads, maximum 17½, minimum 14½ inches; measured from level of tops of rails to center line of coupler.
<i>Note:</i> In case of couplers with offset heads, measure from center of coupler head. This is preferable point of measurement with all couplers.	

Uncoupling Levers

<i>Number</i>	Two.
<i>Dimensions</i>	On undershot couplers with lift-up uncoupling levers, handles should be not less than 12" nor more than 15" over all. They should be so constructed or applied as to give a minimum clearance of 2" around handle for at least 4" of its gripping end. Minimum length of ground uncoupling attachment, 42" measured from center line of car to handle or attachment, except that on narrow gauge cars uncoupling attachments shall extend to within 12" of side of car, and need not be 42" in length.
<i>Location</i>	One on each end of car. (When cars are shopped, double levers should be applied). Uncoupling levers shall be applied so they can be operated by a person standing on the ground.
<i>Manner of Application</i>	When uncoupling lever castings or brackets are renewed or applied, they should be fastened with bolts.

Passenger Train Cars with Wide Vestibules

(See requirements common to all Passenger Cars)

Vestibule Steps

<i>Number</i>	Four.
<i>Dimensions</i>	None stipulated, but the following should be observed. Height above rail—maximum 24"—preferably 19". Outside edge not to project beyond face of side of car. Horizontal depth of step should not be less than 7", nor vertical height more than 13", spaced equally. Minimum length of step 24".
<i>Location</i>	One at each vestibule entrance.
<i>Manner of Application</i>	Securely fastened with preferably not less than 5/8" bolts or rivets.

Side Handholds

<i>Number</i>	Eight.
<i>Dimensions</i>	Minimum diameter 5/8", metal. Minimum clear length, 16". Minimum clearance, 1¼", preferably 2".

<i>Location</i>	Vertical: One on each vestibule door post.
<i>Manner of Application</i>	Securely fastened with preferably $\frac{1}{2}$ " bolts or rivets, or with screws.

Passenger Train Cars with Open End Platforms

(See requirements common to all Passenger Cars)

Platform Steps

<i>Number</i>	Four.
<i>Dimensions</i>	None stipulated, but the following should be observed. Height above rail—maximum 24"—preferably 19". Outside edge not to project beyond face of side of car. Horizontal depth of step should not be less than 7", nor vertical height more than 13", spaced equally. Minimum length of step 24".

<i>Location</i>	One at each platform entrance .
<i>Manner of Application</i>	Securely fastened with preferably not less than $\frac{5}{8}$ " bolts or rivets.

End Platform Handholds

<i>Number</i>	Four. (Platforms equipped with safety-gates do not require end platform handholds.)
<i>Dimensions</i>	Minimum clearance, between supports or fastenings, 2", preferably $2\frac{1}{2}$ ", metal.
<i>Location</i>	Horizontal, from or near door-post to a point not more than 12" from corner of car, then approximately vertical to a point not more than 6" from top of platform. Horizontal portion shall be not less than 24" in length nor more than 40" above platform.
<i>Manner of Application</i>	Securely fastened with preferably not less than $\frac{1}{2}$ " bolts or rivets, or with screws.

Passenger Train Cars without End Platforms

(See requirements common to all Passenger Cars)

Sill Steps

<i>Number</i>	Four.
<i>Dimensions</i>	Minimum length of tread, 10", preferably 12". Minimum cross-sectional area, $\frac{1}{2}$ " by $1\frac{1}{2}$ " or equivalent, wrought iron or steel. Minimum clear depth, 8". Preferred horizontal clearance, 5". measured from outside edge of sill step toward longitudinal center line of car, for full length and minimum clear depth; if more than one tread is used, the same clearance requirements shall apply to each tread.
<i>Location</i>	One near each end on each side not more than 24" from corner of car to center of tread of sill-step. Outside edge of tread of step shall be not more than 2" inside of face of side of car.

Tread shall be not more than 24", preferably not more than 19", above the top of rail.

Manner of Application Step exceeding 18" in depth shall have an additional tread and be laterally braced.

Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Side Handholds

Number Four or more.

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 16" preferably 24". Minimum clearance, 2", preferably $2\frac{1}{2}$ ".

Location If horizontal: One near each end on each side of car over sill step, not less than 24" nor more than 30" above center line of coupler. If an additional handhold is applied over sill step it shall be not less than 42" nor more than 48" above center line of coupler. Clearance of outer end of handhold should be not more than 8" from corner of car.

If vertical: One near each end of car on each side, preferably located between vertical lines passing through ends of sill step tread; and preferably not more than 8" from corner of car; lower end not less than 18" nor more than 24" above center line of coupler.

A vertical handhold not less than 24" in clear length shall be applied on door post above each sidedoor sill step.

Manner of Application Securely fastened with preferably $\frac{1}{2}$ " bolts or rivets, or with screws.

End Hand Rails

(On cars with projecting end-sills)

Number Four.

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel. Minimum clearance, between supports or fastenings, 2" preferably $2\frac{1}{2}$ ".

Location One on each side of each end, extending horizontally from door-post or vestibule-frame to a point not more than 6" from corner of car, then approximately vertical to a point not more than 6" from top of projecting end-sill; horizontal portion shall be not less than 30" nor more than 60" above platform end-sill.

Side Door Steps

Number One or more under each door.

Dimensions Minimum length of tread, 10", preferably 12". Minimum cross-sectional area, $\frac{1}{2}$ " by $1\frac{1}{2}$ " or equivalent, wrought iron or steel. Minimum clear depth, 8". Preferred horizontal clearance, 5", measured from outside edge of sill step towards longitudinal center line of car, for full length and minimum clear depth. If more than

one tread is used, the same clearance requirements shall apply to each tread.

Location Under door at opening side; preferably one under each side of door. Outside edge of tread of step not more than 2" inside of face of side of car.

Manner of Application Step exceeding 18" in depth shall have an additional tread and be laterally braced. Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Special Memoranda On Passenger Cars

1. There is no distinction between passenger and freight cars, and handholds must therefore be placed on the ends of passenger cars and cabooses.

2. When any train is operated with power or train brakes, not less than 85% of the cars of such train shall have their brakes used and operated by the engineer of locomotive drawing such train, *and all power-brake cars in every such train which are associated with the 85 per cent shall have their brakes so used and operated.*

3. On passenger train cars, used in freight or mixed train service, the uncoupling attachments shall be so applied that the coupler can be operated from left side of car.

4. Passenger train cars, such as refrigerators, etc., when hauled in Freight trains must comply with the Safety Appliance requirements for Freight cars.

5. Baggage cars that have open platforms with steps and handrails do not require sill steps and handholds at side doors.

6. The reason why only $1\frac{1}{4}$ " clearance is required on vertical grab irons located on vestibule door post is that these grabs were designed for use only when train is stationary.

7. It is not permissible to extend handholds beyond corner of car to get required clear length.

8. To provide for usual inaccuracies of manufacturing and for wear, where sizes of metal are specified, a total variation of five (5) per cent below size given is permitted.

9. Where $\frac{5}{8}$ " grab irons (or any other size) are flattened at ends for punching of holes to take bolts, they will not be of original thickness. As long as the same cross-sectional area is available, this meets the intent of the law.

Definitions

Face of End Sill When channel iron or I beam is used for end-sill, with flanges projecting outward, the term "face of end

sill" includes upper face of bottom flange and lower face of top flange in addition to vertical face of web.

Sub-Para. (X) STEAM LOCOMOTIVE SAFETY APPLIANCE REQUIREMENTS

Requirements Common To All Steam Locomotives

Handbrakes

Hand brakes will not be required on locomotives nor on tenders when attached to locomotives. If tenders are detached from locomotives and used in special service, they shall be equipped with efficient hand brakes, in accordance with Plate A.

Ruling Tenders used on locomotives need no hand brakes even if there are two tenders, so long as they are attached to locomotive for exclusive purpose of supplying water and fuel to that locomotive. If transported separately they must be equipped with hand brakes.

Brake Beam Guards or Finger Guides

Outside body-hung brake beams on tenders must be provided in all cases with two guards or finger guides each and should be securely fastened to beam with not more than $1\frac{1}{2}$ " (preferably 1") clearance between guard or guide and back of flange of wheel.

Running Boards

Number Two.
Dimensions Not less than 10" wide. If of wood, not less than $1\frac{1}{2}$ " in thickness; if of metal, not less than $\frac{3}{16}$ " in thickness; properly supported.

Location One on each side of boiler extending from cab to buffer beam. On locomotives of the Mallet type, running board should be continuous on sides and across front end. (Running boards extending to front end of smoke-box which are provided with suitable steps to level of top face of buffer beam may take the place of continuous running board.)

Running board may be in sections, when necessary, provided that the space between adjacent sections shall not exceed 28" preferably 24". Flat-top steam chests may form sections of running boards. If the space between sections on each side of compressor exceeds 28", preferably 24", section of running board with suitable steps thereto shall be applied over compressor, or if the equipment consists of more than one compressor a suitable step or section may be applied between compressors. If compressors are so located that section of running board cannot be applied over top of same, the outside edge of running board should extend at least to outer diameter of compressor and for a distance of not less than 12" on each side of compressor.

Locomotives having Wooten type boiler with cab located on top of boiler more than 12" forward from boiler head, shall have suitable running board extending from cab to rear of locomotive, with hand rails not less than 20" nor more than 48" above outside edge of running boards, securely fastened with bolts or rivets.

*Manner of
Application*

Securely fastened with bolts, rivets or studs.

Note (i) If the full 10" width of running boards is interfered with for a distance of 28" or more, at least 7" width of clearance should be allowed to remain.

Note (ii) If running board is in sections. the distance a person would be called upon to step up or down when passing from one section to another should not exceed 24" or if to step across on the same level must not exceed 28", preferably not more than 24". These measurements apply to all parts of running boards, whether steps or sections of the board itself.

Note (iii) When running boards are in sections, and step or steps provided leading from one section to another, such step or steps should be the full width of the running board, and preferably not less than 8" deep.

Hand Rails

(A) *Boiler Side Safety Railings* Two 1" wrought iron or steel hand rails securely fastened on either side of boiler, extending from within 6" of cab (preferably fixed to cab) to front end of boiler not less than 24" nor more than 66" above running board for its full length.

Note (i) Boiler side safety railing *may* extend along either side of boiler and continue across front of boiler, forming front boiler safety railing referred to in sub-paragraph (C).

Note (ii) The Boiler Side Safety Railing requires 2" clearance. When fouled by injectors, sand pipes, conduits, etc., clearance can be obtained by placing shims at back of stands, or applying longer stands, (latter preferred).

Note (iii) Railings found to have moved longitudinally and come out of socket at cab end are to be fixed permanently by flattening ends for 6", turning up at right angles, and securely bolting to cab with two ½" bolts. This is to be a standard practice for both renewals and repairs.

Note (iv) A number of boiler safety railings have been carried behind injector pipes, entirely destroying their purpose. These hand rails should be run out and around injector pipes, maintaining a full 2" (preferably 2½") clearance from them. A similar condition also exists in relation to dynamo stands, and the same remedy is applicable. It is of the utmost importance that injector pipes near hand rails be covered with asbestos lagging to prevent burning of hands.

(B) *Auxiliary Hand Railing above Running Board over Air Pump.* There must be a handrail at least 24" above running board over air pump, approximately the same length as auxiliary running board, and often this is not obtained on account of the long hand rail not being bent up to provide for this feature. It is advisable where such is the case to provide an auxiliary hand rail above existing one, but it must pass outside of steam turbine brackets with a full 2" (preferably 2½") clearance, and this extra hand rail shall be at least 24" above the running board. The bending up of the long handrail must be carried out whenever possible.

(C) *Front Boiler Safety Railings* A front safety railing must be provided and shall be not less than 24" nor more than 66" above buffer beam, or front auxiliary running board if used. Either a horizontal straight, (See Note (i) of Sub-paragraph A), or a circular hand rail will meet the law, provided that at every point across front of

boiler, the railing comes within the minimum of 24" and maximum of 66", and has a full 2" clearance.

Ruling The hand rail across front end of boiler is measured from top of pilot beam or front end running board for height. It is measured from the pilot beam if a 7" walking space is available, and from running board if not.

Note (i) On small power where boilers are located close to buffer beam and circular front end hand rail (with closed portion down) is used, it sometimes comes closer to buffer beam than 24". If this condition exists it can generally be corrected by reversing circular hand rail so closed portion is up, but in reversing care should be taken that the maximum height of 66" is not exceeded. Where boilers are located higher from beam and have a circular hand rail with closed end up, no part of same should exceed 66" from beam, and if so it can be corrected by reversing hand rail so closed portion is down, taking care that the minimum of 24" is maintained.

Note (ii) The clearance of front circular hand rail across front of boiler is often fouled by projecting front end bolts and plugs. These rails must have a full 2" (preferably 2½") clearance and this can be obtained by placing shims under stands, or applying longer stands (preferred).

Note (iii) Some locomotives are found with no hand rail in front of boiler, and others with a horizontal rail above the 66" maximum, both of which are defects.

(D) *Hand Railing for Front Steps* On locomotives with front ladder steps, safe and suitable handrails shall be applied, extending from a point near front end of side handrail to top of buffer beam, except on Mallet type of locomotive, when safe and suitable handrails shall extend from a point at or near front end of side running board to buffer beam.

End Ladders

A suitable metal end or side ladder shall be securely fastened with bolts and rivets to all tanks more than 48" in height measured from top of end sill. Following are preferred measurements:

Preferable clear length of tread if on side 16", if on end 14". Preferable maximum spacing between ladder treads, 19". Top ladder tread should be located not less than 1" nor more than 18" from top of tank. Spacing of ladder treads should be uniform within a limit of 2" from top of ladder tread to bottom tread of ladder. Maximum distance from bottom tread of side ladder to top tread of sill step, 21". Iron or steel treads, minimum diameter 5/8". Minimum clearance of treads 2", preferably 2½".

..Hand Rails and Steps for Headlights

Locomotives having headlights which cannot be safely and conveniently reached from running board pilot beam or steam chests shall be equipped with secure hand rails and steps suitable for the use of men in getting to and from such headlights.

Couplers

Locomotives shall be equipped with couplers coupling automatically by impact, which can be coupled and uncoupled without the necessity of

men going between the rails, one at rear of tender and one at front of locomotive. Distance from guard arm of coupler to knuckle must not exceed $5\frac{1}{8}$ " , measured perpendicularly to face of guard arm. Couplers must be maintained between a minimum height of $31\frac{1}{2}$ " and a maximum of $34\frac{1}{2}$ " (preferred) from top of rails to center of face of knuckle.

Uncoupling Levers

Two double or four single levers, operating from either side, on rear of tender and on front end of locomotive. Handles shall be not more than 12", preferably 9", from end of buffer beam or end sill, and shall be so constructed as to give a minimum clearance of 2" around handle for at least 4" at gripping end. Minimum length of uncoupling lever handle—preferably 12" over all, maximum preferably 15" over all. Center of lift arm eye hole should be not more than $31\frac{1}{2}$ " beyond a vertical line through center of pin hole of coupler. (Length of lift arm of uncoupling lever should be not less than 7" from center of rotating member to center of eye hole).

Note (i) Do not have doubled reversed offsets at bottom of cut lever handle; simply have one offset from vertical to horizontal. This will assist in maintaining uncoupling lever handle clearance.

Note (ii) Brackets of uncoupling levers are often placed so as to allow several inches lateral play, which causes handle clearance to be fouled by top pilot plank. This can be corrected by either moving brackets to extreme outside position (preferred) or spot welding clamps to lever..

Tenders

In addition to the appliances already prescribed, the following requirements are necessary in connection with the maintainance of tenders:

- (a) The difference in height between the deck of the tender and the cab floor or deck on the locomotive shall not exceed $11\frac{1}{2}$ ".
- (b) Friction side bearings shall not be run in contact.
- (c) The maximum clearance of side bearings on rear truck shall be $\frac{3}{8}$ ", and if used on front truck $\frac{3}{4}$ ", when the spread of side bearings is 50". When the spread of side bearings is decreased, the maximum clearance may be increased in proportion.

Tenders of Vanderbilt Type and Similar Designs

Tenders known as the Vanderbilt type shall be equipped with running boards; one on each side of tender not less than 10" in width and one on top of tender not less than 48" in width, extending from coal space to rear of tender.

There shall be a handrail on each side of top running board, extending from coal space to rear of tank, not less than 1" in diameter and not less than 20" in height above running board from coal space to manhole.

There shall be a handrail extending from coal space to within 12" of rear of tank, attached to each side of tank above side running board, not less than 30" nor more than 66" above running board.

There shall be one vertical handhold on each side of Vanderbilt type of

tender, located within 8" of rear of tank extending from within 8" of top of end sill to within 8" of side handrail. Post supporting rear end of side running board if not more than 2" in diameter and properly located, may form section of handhold.

If tender is not equipped with vestibule an additional horizontal end handhold shall be applied on rear end, located not less than 30" nor more than 66" above top of end sill. Clear length of handhold, not less than 48".

Ladders shall be applied at forward ends of side running boards.

When side running boards are located above center line of tender, ladders shall be applied at rear ends of side running boards.

Steam Locomotives Used In Road Service

(See requirements common to all steam locomotives)

Tender Sill Steps

Number Four sill steps; preferably all box type, or two stirrup and two box type.

Dimensions Bottom tread shall be not less than 8" in width by 12" in length; shall have a minimum clear depth of 8", and should be not more than 24", preferably not more than 19", above the top of rail. When the height of deck of tender at gangway or of top face of end sill at rear of tender exceeds 21" above the top face of bottom tread, additional treads not less than 6" by 8" with a minimum clear depth of 6" shall preferably be applied. The spacing between treads should not exceed 19". (Box-sill steps may have metal or wooden treads.) Stirrup steps may be used on sides at rear of tenders and shall have a minimum clear length of tread 10", preferably 12", with a minimum clear depth of 8".

Location One near each corner on sides of tender.

Manner of Application Securely fastened with not less than 1/2" bolts with nuts outside (when possible) and riveted over or with not less than 1/2" rivets.

Note (i) Tender sill steps must be 8" x 12" and pilot sill steps need only be 8" x 10". These dimensions are sometimes confused.

Note (ii) If wooden treads are bolted to metal box type steps, and wooden treads are wider than metal steps, the overhang must be protected from breaking off by use of split bolts or by applying wooden treads with grain running laterally.

Pilot Sill Steps

Number Two.

Dimensions Tread shall be not less than 8" in width by 10" in length, and should have a back stop or flange not less than 2" high at rear and preferably inside edges. (Pilot sill step may have metal or wooden tread.)

Location One on or near each end of buffer beam outside of rail and not more than 16", preferably not more than 12" above level of tops or rail.

Manner of Application Securely fastened with bolts or rivets, preferably not less than $1\frac{1}{2}$ ".

Note: Pilot sill steps may be located on pilot or suspended from buffer beam, either in front or directly behind, but must comply with dimensions and height specified.

Pilot Beam Hand Holds

Number Two.

Dimensions Minimum diameter $\frac{5}{8}$ ", wrought iron or steel. Minimum clear length, 14", preferably 16". Minimum clearance $2\frac{1}{2}$ "

Location One on each end of buffer beam. (If uncoupling lever extends across front end of locomotive to within 8" of extreme end of buffer beam, and is $\frac{7}{8}$ " or more in diameter, with a clearance of $2\frac{1}{2}$ ", for not less than preferably 24" from each end bracket, it is a handhold.)

Manner of Application Securely fastened with bolts or rivets, preferably not less than $1\frac{1}{2}$ ".

Side Handholds

Number Six.

Dimensions Minimum diameter, if horizontal, $\frac{5}{8}$ "; if vertical, $\frac{7}{8}$ ", or equivalent, wrought iron or steel. Horizontal minimum clear length, 16". Vertical, clear length equal to approximate height of tank. Clearance of lower end of handhold preferably not more than 48" above top of rail. Minimum clearance 2", preferably $2\frac{1}{2}$ ".

Location Four must be vertical, $\frac{7}{8}$ " diameter, clear length equal to approximate height of tank and located one on each side of locomotive at gangway and one on each side of tender near gangway.

The two located at rear of tender can be either horizontal or vertical. If horizontal they must be at least $\frac{5}{8}$ " in diameter with a clear length of at least 16", applied on each side not more than 8" from inside clearance to rear of tender, and not less than 24" nor more than 30" above center line of coupler. If vertical they must be $\frac{7}{8}$ " diameter with a clear length equal to approximate height of tank, and located one on each side of tender within 6" of rear or on corner.

Ruling Clearance of side vertical hand holds on tenders at gangway and at rear must extend to within 8" preferably 6" of bottom of tank and to within 8" preferably 6" of water line at top (flare of tank not to be considered.)

Note (i) Vertical grabs at gangways should be so arranged that a person leaving cab is able to see them before descending. In some cases it is necessary to take one or even two steps down from cab before both grabs can be seen.

Note (ii) As the rules for Locomotive Inspection provide that the minimum width of gangway between locomotive and tender, while standing on straight track, shall be 16", it becomes necessary that vertical grabs at cab entrance be not less than 16" (preferably 18" or more) from inside face to inside face of grabs.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts or rivets.

Rear End Hand Holds

Number Two.

Dimensions Minimum diameter, $\frac{5}{8}$ ", wrought iron or steel.
Minimum clear length, 14". Minimum clearance 2", preferably $2\frac{1}{2}$ ".

Location Horizontal; one near each side of rear end of tender on face of end sill, preferably not less than 30" above top of rail. Clearance of outer end of handhold shall be not more than 16" from side of tender.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts or rivets.

Note: These end sill handholds must be maintained on engines used in road service regardless of other appliances such as switch foot boards and hand rails.

End Ladder Clearance

No end ladder clearance is specified for road engines. If a road engine is temporarily equipped with a foot board, it still does not need end ladder clearance as the mere presence of a foot board does not alter the classification.

Steam Locomotives Used In Switching Service

(See requirements common to all Steam Locomotives)

Foot Boards

Number Two or more.

Dimensions Minimum width of tread, 10", wood. Minimum thickness of tread, $1\frac{1}{2}$ ", preferably 2". Minimum height of back-stop, 4" above tread. Preferable minimum height of inside end-foot-guards, on sectional foot-boards, 4" above tread. Height from top of rail to top of tread, not more than 12" nor less than 9"

Location On ends or sides. If on ends, they shall extend not less than 18" outside of gauge of track, and shall be not more than 12" shorter than buffer beam at each end, and preferably should extend to within 6" of side of engine cab or tender.

Manner of Application Footboard may be constructed in two sections, provided that practically all space on each side of coupler is filled; each section shall be not less than 3' in length.

Footboard shall be securely bolted to two 1" by 4" metal brackets provided footboard is not cut or notched at any point. If footboard is cut or notched or in two sections, not less than four 1" by 3" metal brackets shall be used, two located on each side of coupler, and footboard shall be bolted thereto as specified above. Each bracket shall be securely bolted to buffer beam, end sill, or tank frame, by not less than two $\frac{7}{8}$ " bolts. If side foot-

boards are used, a substantial handhold or rail shall be applied not less than 30" nor more than 60" above tread of footboard.

Note: It is not permissible to substitute brackets of less than 1" thickness by increasing the width to obtain the same cross-sectional area. All foot board brackets bear the strain against their thickness and a full 1" thickness must be maintained.

Tender Sill Steps

<i>Number</i>	Two or more, preferably box type.
<i>Dimensions</i>	Bottom metal tread shall be not less than 8" in width by 12" in length, and should have a minimum clear depth of 8", and should be not more than 24", preferably not more than 19", above the top of rail.

When the height of deck of tender at gangway exceeds 21" above the bottom tread, additional treads, not less than 6" by 8" should preferably be applied, with 6" of clear depth.

The spacing between treads should not exceed 19". (Sill steps may have wooden treads.)

<i>Location</i>	One or more on each side at gangway secured to tender.
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<i>Manner of Application</i>	Securely fastened with bolts or rivets, preferably $\frac{1}{2}$ ", and when bolts are used, have nuts outside when possible, and riveted over.
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Note: If wooden treads are bolted to metal box type steps and wooden treads are deeper than metal steps the overhang should be protected from breaking off by the use of split bolts or by applying wooden treads with grain running laterally.

End Hand Holds

<i>Number</i>	Two.
<i>Dimensions</i>	Minimum diameter 1", wrought iron or steel. Minimum clearance, between end and center supports 4", except at coupler casting or braces, when minimum clearance shall be 2".

<i>Location</i>	One on pilot buffer-beam; one on rear end of tender, extending across front end of locomotive and rear end of tender to within not less than 6" from ends of buffer beam or end sill.
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<i>Manner of Application</i>	Securely fastened at end and center supports with bolts or rivets, preferably not less than $\frac{1}{2}$ ".
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Note (i) This provision does not exempt uncoupling lever brackets and end ladders, and therefore a full 4" of clearance must be maintained from these items. Do not interpret "coupler casting or braces" to mean "uncoupling lever brackets."

Note (ii) Some switch engines are found operating with no horizontal end hand rail, indicating that the provision under road locomotives, for front uncoupling levers to substitute for pilot beam hand hold, it being erroneously interpreted as applicable to switch engines. It should be distinctly understood that every foot board must have a hand rail in addition to the cut lever.

Side Handholds

<i>Number</i>	Four.
<i>Dimensions</i>	Minimum diameter, $\frac{7}{8}$ ", or equivalent, wrought iron or steel. Clear length equal to approximate height of tank, lower end preferably not more than 48" above top of rail. Minimum clearance, 2", preferably $2\frac{1}{2}$ ".
<i>Location</i>	Vertical. One on each side of tender near front corner; one on each side of locomotive at gangway.
<i>Manner of Application</i>	Securely fastened with bolts or rivets, preferably not less than $\frac{1}{2}$ ".
<i>Ruling</i>	Side vertical hand rail on tenders at gangways must extend to within 8" preferably 6" of bottom of tank and to within 8", preferably 6", of water line at top (flare of tank not to be considered.)

Note (i) Vertical grabs at gangways should be arranged so that a person leaving cab is able to see them *before* descending. In some cases it is necessary to take one or even two steps down from cab before both grabs can be seen.

Note (ii) As the rules for Locomotive Inspection provide that the minimum width of gangway between locomotive and tender, while standing on straight track, shall be 16", it becomes necessary that vertical grabs at cab entrance be not less than 16" (preferably 18" or more) from inside face to inside face of grabs.

Hand Rails and Steps for Headlights

Switch locomotives with sloping tenders with manhole or headlight located on sloping portion of tender shall be equipped with secure steps and hand rail or with platform and hand rail leading to such manhole or headlight.

End Ladder Clearance

No part of locomotive or tender more than 20" from longitudinal center line of locomotive and tender, except foot boards and handles of uncoupling levers, and no part of locomotive or tender less than 20" from longitudinal center line of locomotive and tender except draft-rigging, coupler attachments, safety chains, buffer block, footboard, brake pipe, steam-heat pipe, signal pipe or uncoupling attachments, shall extend to within 14" of a vertical plane passing through inside face of knuckle when closed with horn of coupler against buffer block or end sill.

Note (i) The proper method of ascertaining end ladder clearance on a steam locomotive or tender is:—

- (a) Measure distance from inside face of knuckle when closed, to back of horn of coupler ascertaining whether it be $9\frac{1}{4}$ ", 12", or $12\frac{1}{4}$ " head.
- (b)) Measure distance from end of tank or buffer beam to face of buffer block.
- (c) Measure distance from end of tank or buffer beam to closest obstruction other than those excepted.

Add (a) plus (b) and subtract (c). The result is end ladder clearance.

Special Memoranda On Steam Locomotives

(1) It is permissible to equip a road engine with foot boards, where necessary on account of way freight service, etc., but all the appliances for a road engine must be maintained, such as end sill handholds, tender sill steps, etc. Steam locomotives used in either switching or road service must conform to the requirements prescribed for service in which locomotive is used, but no exceptions will be taken to the equipping of a steam locomotive with appliances for both road and switching service, providing no part of one appliance interferes with the free and unobstructed use of any other prescribed appliance.

(2) Use of a flat car or other car coupled to a road engine and used for switching does not relieve the engine from meeting the requirements of a switch engine at both ends.

(3) It is a violation of the order to use a road locomotive as a switch engine, but is generally allowed in cases of extreme emergency, when same is not used for more than one 8-hour shift.

(4) In figuring percentage of operative brakes, the engine and tender is counted as two cars.

(5) When two engine tenders are coupled together by a shackle bar and used as a water car it is a violation; each tender should be equipped as a car with couplers in both ends.

(6) Any detached locomotive tender hauled in a train must be considered as a car, and be equipped with the necessary appliances. It must have a hand brake, also sill steps and end sill grab irons in a similar location to those on box cars. There must be two uncoupling levers, one on each end, and two couplers which will couple automatically by impact, and which can be coupled and uncoupled without the necessity of men going between the ends of cars.

(7) Even if a stub pilot is used on rear of tender, there must be, nevertheless, the prescribed two end sill hand holds with 2" clearance for at least 14", located not more than 16" from side of tender.

(8) Switch engines hauled dead in a train must have the safety appliances prescribed for switch engines. If footboards are removed, sill steps, end sill and pilot beam hand holds must be applied.

(9) Road engines hauled dead in a train must have the safety appliances prescribed for road engines. If pilot is removed, sill steps and pilot beam hand holds must be applied.

(10) Locomotives, while equipped with snow plows or flangers, are to be regarded as cars of special construction within the meaning of the order. Sill steps are not required on plows or flangers, but if provided must measure at least 8"x10" and be not more than 16" above rail, and be located outside of rails. (Inside face of ball).

(11) Snowplows may be closed on plow end, and coupler removed. This applies to both regular snow plows and plows affixed to cars.

(12) To provide for usual inaccuracies of manufacturing and for wear, where sizes of metal are specified, a total variation of five (5) per cent below size given is permitted.

(13) Where $\frac{5}{8}$ " grab irons (or any other size) are flattened at ends for punching of holes to take bolts, they will not be of original thickness. As long as the same cross-sectional area is available, this meets the intent of the law.

Definitions

Side of Tender The term "side of tender" refers to the side of the tank, and not to the side of the frame.

Sub-Para. (XI) ELECTRIC LOCOMOTIVE SAFETY APPLIANCE REQUIREMENTS (Preferably)

Requirements Common To All Electric Locomotives

Side Sill Steps

Number Two or more.

Dimensions Tread shall be not less than 6" in width by 12" in length; shall have a minimum clear depth of 8" and shall be not more than 24", preferably not more than 19", above top of rail. When height of floor level exceeds 21" above top face of bottom tread, additional treads not less than 6" by 12" with minimum clear depth of 6", shall be applied. The spacing between treads shall not exceed 19". (Sill steps may have metal or wooden treads.)

If stirrup steps are used, they shall be of cross sectional area not less than $\frac{1}{2}$ " by $1\frac{1}{2}$ ", wrought iron or steel.

Clear length of tread shall be not less than 10", preferably not less than 12" with a minimum depth of 8".

Location One under each side entrance. Locomotive not provided with an end platform, if construction of frame or superstructure permits, shall have a sill step located on each side near each end. (Not required on switch locomotives).

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over or with not less than $\frac{1}{2}$ " rivets.

Side Handholds

Number Four or more.

Dimensions Minimum diameter; horizontal, $\frac{5}{8}$ " (not required on switch locomotives) vertical, $\frac{7}{8}$ ", or equivalent; wrought iron or steel. Vertical, minimum clear length at door location, 48"; at platform sill-step location 36". Clearance of lower end of vertical handhold, preferably not more than 48" above top of rail. Minimum clearance, $2\frac{1}{2}$ ".

Location One, vertical, on each side of each side-door; one on each side of entrance to side or end-platform at sill-step location. If additional sill-step is applied near end of locomotive, a horizontal side handhold shall be applied over step.

Manner of Application Securely fastened with bolts or rivets.

Couplers

Number Two.

Location One on each end of locomotive.

Manner of Application Each locomotive shall be equipped with couplers coupling automatically by impact, and which can be coupled and uncoupled, without the necessity of men going between the ends of cars. Couplers shall be attached to locomotive in a safe and secure manner.

Uncoupling Levers

Number Two double or four single.

Dimensions Handle of uncoupling lever shall be not more than 12", preferably not more than 9", from end of buffer-beam or end-frame, and so constructed as to give a minimum clearance of 2" around handle. Maximum drop of handle of uncoupling lever of type shown on Plate B, 15". (Any efficient uncoupling mechanism may be used.)

Location On each end of locomotive.

Manner of Application Securely fastened with bolts or rivets.

Requirements for Electric Locomotives Used In Road Service (Preferably)

(See requirements common to all Electric Locomotives)

Pilot Sill Steps

Number Two at each pilot location.

Dimensions Tread shall be not less than 8" in width by 10" in length, and shall have a backstop or flange not less than 2" high at rear and inside edges. (Pilot sill step may have metal or wooden tread.)

Location One on or near each end of buffer beam or end frame outside of rail and not more than 16", preferably not more than 12", above top of rail.

Manner of Application Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over or with not less than $\frac{1}{2}$ " rivets; if box type of step is used it shall be so applied that outside edge of bottom tread shall project not less than 4" beyond face of buffer beam or end frame.

End Hand Holds

Number Four or more.

Dimensions Horizontal; minimum diameter, $\frac{5}{8}$ "; vertical minimum diameter, $\frac{7}{8}$ " or equivalent; wrought iron or steel.

Horizontal, minimum clear length 14", preferably 16"; vertical minimum clear length 30"; preferably 36". Minimum clearance 2½".

Location One horizontal, on or near each end of buffer-beam or end-frame; clearance of outer end of handhold shall be not more than 16" from end of buffer-beam or end-frame. (If uncoupling lever extends across end of locomotive to within 8" of end of buffer-beam or end-frame and is 7/8" or more in diameter, with a clearance of 2½" for not less than 24" from each end bracket, it is a handhold.) One vertical on each side of end door. (If construction of locomotive requires, additional horizontal or vertical end-handholds shall be applied to afford safe access to marker locations.)

Manner of Application Securely fastened with bolts or rivets, preferably not less than ½".

End Ladder Clearance

No end ladder clearance is specified for road engines. If a road engine is temporarily equipped with a foot board, it still does not need end ladder clearance as the mere presence of a footboard does not alter the classification.

Hand Rails

Locomotives having open end or side-platforms shall be provided with suitable hand-rails, extending from sill-step location to end-door and around sides and ends of platforms.

Manner of Application Securely fastened with not less than ½" bolts or rivets.

Requirements for Electric Locomotives Used In Switching Service **(Preferably)**

(See requirements common to all Electric Locomotives)

Foot Boards

Number Two.

Dimensions Minimum width of tread, 10", wood. Minimum thickness of tread 1½", preferably 2". Minimum height of back-stop, 4" above tread. Minimum height of inside end-foot-guard of sectional foot-board, 4" above tread. Height from top of tread to top of rail, not more than 12" nor less than 9".

Location On each end of locomotive, extending not less than 18" outside of gauge of straight track. Outside end of tread shall extend to a point not more than 12", measured vertically, from end of buffer beam, end frame, or side of superstructure, provided that where third rail is used, outside end of tread shall extend only to permissible third rail clearance.

Manner of Application Foot-board may be constructed in two sections, provided that practically all space on each side of coupler is filled; each section shall be not less than 3' in length except where third rail clearance does not permit. Footboards shall be so-

curely bolted to two 1" by 4" metal brackets, provided boards are not cut or notched at any point. If cut or notched, or in two sections, they shall be securely bolted to not less than four 1" by 3" metal brackets, two located on each side of coupler. Each bracket shall be securely bolted to buffer-beam or end frame by not less than two $\frac{7}{8}$ " bolts.

End Handholds

<i>Number</i>	Two or more.
<i>Dimensions</i>	Minimum diameter; horizontal, 1", vertical, $\frac{7}{8}$ " or equivalent, wrought iron or steel. Horizontal, minimum clearance between end and center supports or fastenings 4", except at coupler casting or braces, where minimum clearance shall be 2", preferably $2\frac{1}{2}$ ". Vertical minimum clear length, 30" preferably 36".
<i>Location</i>	One horizontal, extending across each end of locomotive, on buffer-beam or end frame; ends of handholds shall be not more than 6" from ends of buffer-beam or end of end-frame. If locomotive has end door, one vertical handhold shall be applied on each side of each door. (If construction of locomotive requires additional horizontal or vertical handholds, a minimum diameter of $\frac{5}{8}$ " shall be applied to afford safe access to marker locations.)
<i>Manner of Application</i>	Securely fastened at ends and center supports by bolts or rivets.

Hand Rails

Locomotive having open-end or side-platforms shall be provided with suitable hand-rails extending from sill-step location to end door.

Locomotive not provided with platform hand-rails and having sloping superstructure shall be equipped with secure hand-rails extending full length and across the end of sloping portion, so located as to provide safety when using platform.

<i>Manner of Application</i>	Securely fastened with bolts or rivets.
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End Ladder Clearance

No part of locomotive more than 20" from longitudinal center line, except foot-board and lift arms of uncoupling levers, and no part of locomotive less than 20" from longitudinal center line except draft rigging, coupler and attachments, safety chains, buffer block, footboard, brake pipe, steam heat pipe or uncoupling attachments, shall extend to within 14" of a vertical plane passing through the inside face of knuckle when closed with coupler horn against buffer-block end-sill or end-frame.

Note (i) The proper method of ascertaining end ladder clearance on an Electric Locomotive is:—

- (a) Measure distance from inside face of knuckle when closed, to back of horn of coupler ascertaining whether it be $9\frac{1}{4}$ ", 12", or $12\frac{1}{4}$ " head.
- (b) Measure distance from end of locomotive to face of buffer block.
- (c) Measure distance from end of locomotive to closest obstruction not excepted.

Add (a) plus (b) and subtract (c). The result is end ladder clearance.

Special Memoranda On Electric Locomotives

(1) It is permissible to equip a road engine with foot boards, where necessary on account of way freight service, etc., but all the appliances for a road engine must be maintained, such as end sill handholds, tender sill steps, etc. Electric locomotives used in either switching or road service must conform to the requirements prescribed for service in which locomotive is used, but no exceptions will be taken to the equipping of an electric locomotive with appliances for both road and switching service, providing no part of one appliance interferes with the free and unobstructed use of any other prescribed appliance.

(2) Use of a flat car or other car coupled to a road locomotive and used for switching does not relieve the locomotive from meeting the requirements of a switch engine at both ends.

(3) It is a violation of the order to use a road locomotive as a switch locomotive, but is generally allowed in cases of extreme emergency, when same is not used for more than one 8-hour shift.

(4) In figuring percentage of air on a train hauled by an electric locomotive, count each independently power-braked truck as one car.

(5) Switch locomotives hauled dead in a train must have the safety appliances prescribed for switch locomotives. If footboards are removed, sill steps, end sill and pilot beam hand holds must be applied.

(6) Road locomotives hauled dead in a train must have the safety appliances prescribed for road locomotives. If pilot is removed, sill steps and pilot beam hand holds must be applied.

(7) Locomotives while equipped with snow plows or flangers are to be regarded as cars of special construction within the meaning of the order. Sill steps are not required on plows or flangers, but if provided must measure at least 8" x 10", be not more than 16" above rail, and be located outside of rails. (Inside face of ball.)

(8) Snowplows may be closed on plow end, and coupler removed. This applies to both regular snow plows and plows affixed to cars.

(9) Front pilot beam sill steps should preferably be arranged so that a man using same can stand in an upright position.

**Sub-Para. (XII) ELECTRIC, GAS-ELECTRIC, OIL, STEAM, AND GASOLINE
MOTOR CAR SAFETY APPLIANCE REQUIREMENTS**

Hand Brake

Number Each car shall be equipped with an efficient hand-brake which shall operate in harmony with the power brake thereon. (See Plate A and General Definition of "Hand Brake").

Location So located that it can be safely operated while car is in motion.

Pilot Sill Steps

<i>Number</i>	Two at each pilot location.
<i>Dimensions</i>	Tread shall be not less than 8" in width by 10" in length and shall have a back-stop or flange not less than 2" high at rear and inside edges. (Pilot sill steps may have metal or wooden treads.)
<i>Location</i>	One on or near each end of end-frame or on pilot, outside of rail and not more than 16", preferably not more than 12" above top of rail.
<i>Manner of Application</i>	Securely fastened with not less than $\frac{1}{2}$ " bolts or rivets.

Sill Steps

<i>Number</i>	Four or more.
<i>Dimensions</i>	Minimum length of tread, 10" preferably 12". Minimum cross-sectional area, $\frac{1}{2}$ " by $1\frac{1}{2}$ " or equivalent wrought iron or steel. Minimum clear depth 8".
<i>Location</i>	One near each end or on corner of car under handhold. Outside edge of tread of step shall be not more than 2" inside of face of side superstructure. Tread shall be not more than 24" preferably not more than 19" above top of rail. (On open platform cars with box sill-steps; other sill-steps are not required on platform end.)
<i>Manner of Application</i>	Steps exceeding 18" in depth shall have an additional tread and be laterally braced. Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Side Door Sill Steps

<i>Number</i>	Two or more.
<i>Dimensions</i>	Minimum length of tread, 10", preferably 12". Minimum cross-sectional area, $\frac{1}{2}$ " by $1\frac{1}{2}$ " or equivalent, wrought iron or steel. Minimum clear depth 8".
<i>Location</i>	One under each door, at opening side. Outside edge of tread of step not more than 2" inside of face of side superstructure. Tread shall be not more than 24", preferably not more than 19", above top of rail.
<i>Manner of Application</i>	Steps exceeding 18" in depth shall have an additional tread and be laterally braced. Securely fastened with not less than $\frac{1}{2}$ " bolts with nuts outside (when possible) and riveted over, or with not less than $\frac{1}{2}$ " rivets.

Side Handholds

<i>Number</i>	Eight or more.
<i>Dimensions</i>	Minimum diameter, $\frac{5}{8}$ " wrought iron or steel. Minimum clear length at vestibule location, 24", preferably 30", with a minimum clearance of $1\frac{1}{2}$ ", preferably 2"; at other locations,

minimum clear length 30", preferably 36", with a minimum clearance of 2", preferably 2½".

Location Vertical, one on each vestibule door-post, one on each side of door at power-plant location; at doors other than power plant and vestibule entrance, one at opening of door, as nearly as possible over sill step.

Vertical or horizontal, one on each end or on corner of car located over sill-step. Lower end of vertical handhold shall be not less than 18", nor more than 24" above center line of coupler; if horizontal, handhold shall be not less than 24" nor more than 30" above center line of coupler.

Manner of Application Securely fastened with bolts or rivets.

End Handholds

Number Four or more.

Dimensions Minimum diameter, 5/8" wrought iron or steel. Minimum clear length 16". Minimum clearance 2", preferably 2½".

Location Horizontal, on each end of car, secured to end-sill, end-frame or superstructure; one over each pilot sill step; one near each side on end without pilot. Clearance of outer end of handhold, not more than 3" from end of end-sill or end frame; if located on superstructure, not more than 10" from side.

One continuous end handhold, extending across or circular with the end-sill, end-frame, or superstructure, to within 3" of end of end-sill, or end-frame; or, if secured to superstructure, to within 10" of each side thereof, with minimum clearance of 2½" between supports or fastenings, it may take the place of end handholds above specified.

On end-platform cars there shall be one horizontal handhold on each side of each end on face of platform end-sill, projecting downward or outward.

Clearance of outer end of handhold shall be not more than 16" from end of end-sill. (If construction of car requires, additional handholds and steps shall be applied to afford safe access to marker and headlight locations.)

Manner of Application Securely fastened at ends and intermediate supports, by bolts or rivets.

End Platform Handholds

Number Two or more (platforms equipped with safety gates do not require end-platform handholds.)

Dimensions Minimum diameter, 5/8", metal. Minimum clearance between supports or fastenings, 2", preferably 2½".

Location Horizontal, from or near door post to a point not more than 12" from corner of car, then approximately

vertical to a point not more than 6" from top of platform. Horizontal portion shall be not less than 24" in length, nor more than 40" above platform.

Manner of Application Securely fastened with bolts, rivets or screws.

Hand Rails

A safe and suitable handrail shall extend across each open end-platform to a point not less than 4" from each end of platform end sill, securely fastened with bolts or rivets.

Couplers

Number Two.
Location One on each end for car.
Manner of Application Each car shall be equipped with couplers, coupling automatically by impact, and which can be coupled and uncoupled, without the necessity of men going between the ends of cars. Couplers shall be attached in a safe and secure manner.

Uncoupling Levers

Uncoupling attachments shall be applied so they can be operated by a person from the left side when standing on the ground. Minimum length of ground uncoupling attachment, 42" measured perpendicularly from longitudinal center line of car to handle of attachment.

Special Memoranda On Electric, Gas-Electric, Oil, Steam and Gasoline Motor Cars

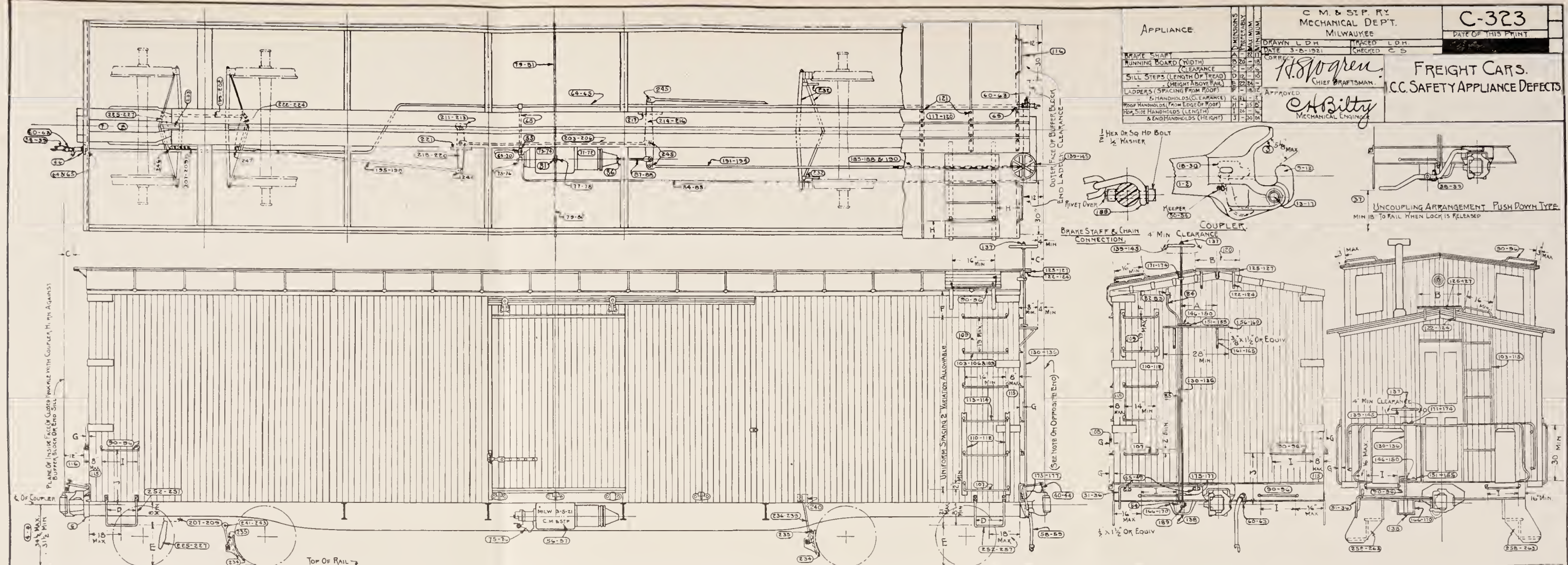
(1) The reason only 11½" clearance is required on vertical grab irons located on vestibule door post is that these grabs are only for use when car is stationary.

(2) When a motor car is hauled dead in a passenger train, the uncoupling attachments must be operative from either side of train, which ordinarily means motor car must have a right uncoupling lever, or a double lever. If car is hauled dead in a freight train the uncoupling attachments must be operative from left side of train, which means motor car must have a left uncoupling lever, or a double lever. (Double levers should be applied whenever possible).

(3) Motor cars hauled dead in a train must have the safety appliances prescribed for same. If pilot is removed, sill steps and pilot beam hand holds must be applied.

(4) Motor cars while equipped with snow plows are to be regarded as cars of special construction within the meaning of the order. Sill steps are not required on plows, but if provided must measure at least 8" x 10" and be not more than 16" above rail, and be located outside of rails. (Inside face of ball).

(5) Snowplows may be closed on plow end, and coupler removed. This applies to both regular snow plows and plows affixed to cars.



- REFERENCE LETTERS**
- A. REPORT AS DEFECTS ONLY WHEN WORK SUFFICIENTLY TO DESTROY CONTOUR LINES BY ALLOWING LOST MOTION TO APPROACH DANGER POINTS AS SHOWN BY M.C.B. GAUGE
- B. INSPECTORS MUST USE JUDGMENT IN DETERMINING DEFECTS OF THIS CLASS; SEE THAT THE CAR IS STANDING ON APPROXIMATELY LEVEL TRACK BEFORE MEASUREMENTS ARE TAKEN. STATE HEIGHT
- C. DESCRIBE DEFECTS
- D. REPORT AS DEFECTS WHEN UNSAFE OR INOPERATIVE
- COUPLER**
- (STATE NAMES OF COUPLERS & PARTS FOUND DEFECTIVE)
1. COUPLER BODY BROKEN
 2. COUPLER BODY MISSING
 3. COUPLER BODY WORN (A)
 4. COUPLER TOO HIGH (B)
 5. COUPLER TOO LOW (B)
 6. CARRIER IRON LOOSE
 7. COUPLER REAR END ATTACHMENTS DEFECTIVE (D-C)
- (REPORT COUPLER YOKES, SIDE RODS, KEYS, SPRINGS AND FOLLOWERS AND FRICTION DRAFT ATTACHMENT FOUND DEFECTIVE)
- DRAFT GEAR DEFECTIVE (D-C)**
- (REPORT BROKEN DRAFT BOLTS AND DRAFT ARMS FOUND DEFECTIVE)
- (KNUCKLE)
8. KNUCKLE BROKEN
 9. KNUCKLE MISSING
 10. KNUCKLE WORN (A)
 11. KNUCKLE PIN BENT
 12. KNUCKLE PIN BROKEN
 13. KNUCKLE PIN MISSING
 14. KNUCKLE PIN WORN (A)
 15. KNUCKLE PIN WORN (A-D)
 16. KNUCKLE PIN WORN (A-D)
 17. KNUCKLE PIN WORN (A-D)
 18. LOCK BLOCK BENT
 19. LOCK BLOCK BROKEN
 20. LOCK BLOCK MISSING
 21. LOCK BLOCK WORN (A)
 22. LOCK BLOCK DISCONNECTED
 23. LOCK BLOCK WORN (D)
 24. LOCK BLOCK INOPERATIVE
 25. LOCK BLOCK KEY MISSING
 26. LOCK BLOCK TRIGGER MISSING
 27. LOCK SET MISSING
 28. LOCK LIFT BENT OR BROKEN
 29. LOCK LIFT DISCONNECTED OR MISSING (C)
 30. LOCK LIFT WRONG OR INCORRECTLY APPLIED (D)
- UNCOUPLING MECHANISM**
- (STATE NAME OF UNCOUPLING MECHANISM FOUND DEFECTIVE)
31. UNCOUPLING LEVER BENT (D)
 32. UNCOUPLING LEVER BROKEN
 33. UNCOUPLING LEVER MISSING
 34. UNCOUPLING LEVER WRONG OR INCORRECTLY APPLIED (C)
 35. UNCOUPLING LEVER STOP MISSING (DEFECTS 37, 38 AND 39 APPLY ONLY TO LEVERS OF THE PUSH DOWN TYPE)
 36. UNCOUPLING LEVER STOP BROKEN LOOSE OR INCORRECTLY APPLIED (C)
 37. UNCOUPLING LEVER HANDLE TOO LOW
 38. UNCOUPLING LEVER STOP BROKEN LOOSE OR INCORRECTLY APPLIED (C)
 39. UNCOUPLING LEVER STOP MISSING (DEFECTS 37, 38 AND 39 APPLY ONLY TO LEVERS OF THE PUSH DOWN TYPE)
 40. UNCOUPLING CHAIN BROKEN
 41. UNCOUPLING CHAIN MISSING
 42. UNCOUPLING CHAIN KINKED
 43. UNCOUPLING CHAIN TOO LONG
 44. UNCOUPLING CHAIN TOO SHORT
 45. END LOCK OR CASTING BENT
 46. END LOCK OR CASTING BROKEN
 47. END LOCK OR CASTING LOOSE (P)
 48. END LOCK OR CASTING MISSING
 49. END LOCK OR CASTING WRONG (D)
 50. KEEPER BENT
 51. KEEPER BROKEN
 52. KEEPER LOOSE (P)
 53. KEEPER MISSING
 54. KEEPER WORN (D)
 55. AIR BRAKE CUT OUT
 56. CYLINDER & TRIPLE NOT CLEANED WITHIN 12 MONTHS; GIVE DATE OF LAST CLEANING
 57. AIR HOSE MISSING
 58. AIR HOSE DEFECTIVE (C)
 59. ANGLE COCK MISSING
 60. ANGLE COCK DEFECTIVE
 61. ANGLE COCK HANDLE BROKEN
 62. ANGLE COCK HANDLE MISSING
 63. BRAKE PIPE BROKEN
 64. BRAKE PIPE LOOSE
 65. ANGLE COCK BRACKET DEFECTIVE
 66. CONDUCTING PIPE DEFECTIVE (REFERS TO CONNECTION BETWEEN BRAKE CYLINDER & RESERVOIR)
 67. BRANCH PIPE DEFECTIVE (REFERS TO CONNECTION BETWEEN 101. LADDER TREAD WITHOUT FOOT-GUARD)
 68. BRANCH PIPE & TRIPLE VALVE (C)
 69. CUT OUT COCK DEFECTIVE (C)
 70. CUT OUT COCK MISSING
 71. CYLINDER CASTING DEFECTIVE
 72. CYLINDER LOOSE
 73. RESERVOIR CASTING DEFECTIVE
 74. RESERVOIR LOOSE
 75. TRIPLE VALVE DEFECTIVE (C)
 76. TRIPLE VALVE MISSING
 77. RELEASE VALVE DEFECTIVE (C)
 78. RELEASE VALVE MISSING
 79. RELEASE ROD DEFECTIVE (C)
 80. RELEASE ROD MISSING
 81. RETAINING VALVE DEFECTIVE OR LOOSE (C)
 82. RETAINING VALVE MISSING OR INCORRECTLY APPLIED (C)
 83. RETAINING PIPE DEFECTIVE
 84. RETAINING PIPE MISSING
 85. PISTON TRAVEL EXCESSIVE (REPORT AS DEFECT WHEN TRAVEL EXCEEDS TEN INCHES)
 86. PUSH ROD DEFECTIVE (C)
 87. PUSH ROD MISSING
 88. AIR BRAKE INOPERATIVE
 89. HANDRAIL BROKEN
 90. HANDRAIL BENT OR NOT HAVING PROPER CLEARANCE (C-D)
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**Sub-Para. (XIII) CLASSIFICATION OF DEFECTS TO
BE REPORTED BY GOVERNMENT INSPECTORS**

Government Inspectors are sent out to check the equipment of all common carriers, and in addition to reporting any violations of the Law and Order, are instructed to report defects. These defects are listed on bottom of the attached print showing location of car safety appliance defects.

In regard to what constitutes a "penalty" defect and what is meant by a "reportable" defect, such classification has never been attempted by the Bureau of Safety, as it is quite impracticable. The classification of Safety appliance defects to be reported by inspectors as of July 1, 1920, quoted herein, is based upon the law and the rules of the American Railway Association. Whether any single defect or combination of defects mentioned in this classification would subject the carrier to penalty or not would depend entirely upon whether or not such defect or combination of defects resulted in a violation of law; as, for instance, a loose carrier iron is a reportable defect but a carrier could not be penalized for moving a car with a loose carrier iron unless the defect resulted in a coupler of less than the legal height. A knuckle pin, for instance, is a reportable defect, but it would not result in penalizing the carrier unless the broken pin made the coupler inoperative; in other words, there are certain definite conditions prescribed by law which must be observed by carriers in the equipment and movement of cars, and any defect or combination of defects which prevent these conditions from being complied with subject the carrier to the penalties prescribed by law. You will readily understand that no classification or rules can be laid down which will specify what is a penalty defect and what is not.

General Note

Throughout this paragraph on Safety Appliances, reference is made to Plates, such as Plate A, Plate B, etc. These Plates are not published herein, but may be studied or read in conjunction with this paragraph by obtaining any one of the several books issued covering official safety appliances.

Para. 9.**WHEELS****Sub-Para. (I)****GENERAL INFORMATION**

There is no more important part of a car, freight or passenger, than the wheels, and inspectors must be thoroughly acquainted with their various features.

There are four classes of wheels in common use, cast-iron, cast-steel, rolled-steel, and steel-tired.

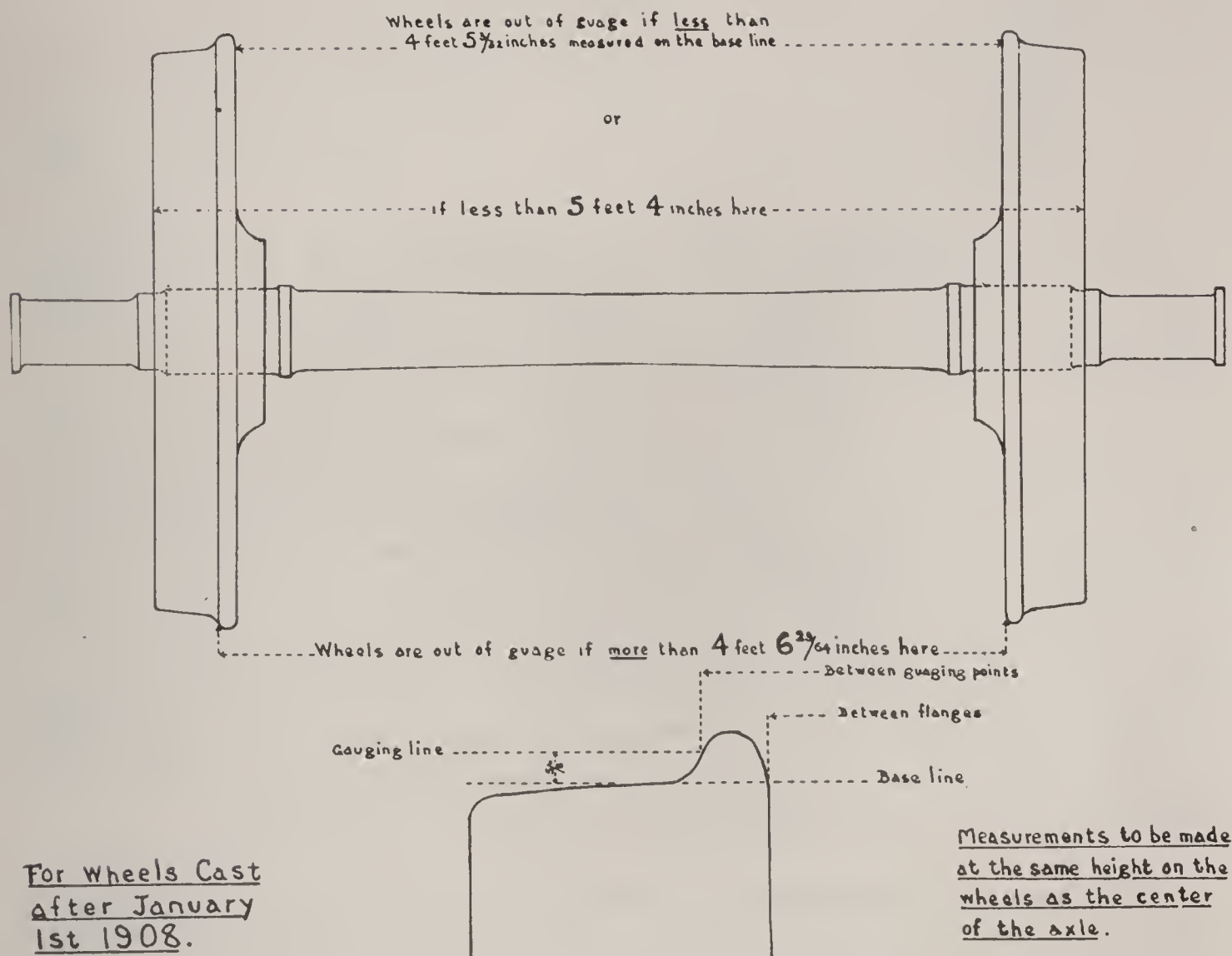
Cast iron wheels are manufactured by pouring into moulds, a mixture consisting of approximately 97% iron and 3% combined carbon, sulphur, manganese, phosphorous, and silicon. There is no A. R. A. specification regarding the chemical composition of the wheel but certain tests are prescribed which the wheel must be able to comply with before being accepted for service. The mixture is poured at a temperature of approximately 2200° F into a specially prepared mould so arranged that the molten metal makes contact with a chiller at a point which is to form the tread and flange of the wheel, and this results in a chilling that hardens and gives the required degree of wear. On a 33" wheel this chill should extend to a minimum depth of 1½", and a maximum depth of 1".

After casting, the wheels are placed in an annealing oven where they remain for 7 days. Following this treatment they are sandblasted and then taped. Taping means the measuring of the circumference of the tread at a specified distance from the rim and this must be carefully done in order that the variation of the different tape-sizes of wheels is not greater than 1/8 of an inch. Wheels are then weighed and if found to be a given amount under weight are rejected.

The tests to which cast-iron wheels are subjected are termed the Drop and Thermal tests, the former consisting of dropping a weight on a wheel from a specified height a certain number of times, and the latter of surrounding wheel with molten cast iron. This is done by placing wheel flange downwards in sand and moulding a channel 1-1½" wide and 4" deep around it. Two minutes after pouring ceases the gas generated in core is ignited, breaking the ring and relieving the pressure. Any crack found extending through or into rim will decide that the wheel has failed. If the selected wheel fails under either test all wheels of the tape-size in question cast from that particular run of metal are rejected. Following these tests each wheel is subjected to a rigid surface examination after which it is ready for mounting for service.

In mounting cast-iron wheels, the wheel seat is bored out at a cutting speed not exceeding 40 to 50 feet per minute. Wheel fit is generally chamfered slightly to make it easier to get the wheel in position for mounting on the axle. Wheels are carefully pressed onto axles at a pressure of 40 to 60 tons for an 80 capacity, increasing proportionately for heavier wheels and decreasing for lighter. Wheels are mounted by straight fit of axles and wheel seat. When mounted, wheels are gauged to see that distances between

flanges, etc., are correct. The requirements for cast iron wheels to be placed under cars are shown below:



Cast steel wheels are cast in a revolving mould, the first metal entering the mould being treated with ferro-manganese in its passage from the ladle to the mould. There are no A. R. A. specifications covering the chemical composition of the steel wheel but as in the case of the cast-iron wheel, it is subjected to tests. The centrifugal action due to the revolving table forces the manganese steel to the circumference of the mould where it forms a hard, tough tread and flange. The manganese steel is immediately followed by, and blends into, a soft, ductile steel which forms the plate and hub.

The tests for a cast-steel wheel consist of a Drop, Thermal and Flange Test. The first two correspond to those for cast-iron but in addition they are given a Flange test by applying static loads in a lateral direction to the flange, and by impact in a lateral direction to the flange. Cast-steel wheels are taped for size the same as cast-iron excepting that the variation in sizes must not exceed $\frac{1}{32}$ of an inch.

Wheels are then mounted as described for cast-iron excepting that the pressure for an 80 M wheel is 60 to 80 tons, and increases proportionately for heavier and decreases for lighter.

Rolled steel wheels are manufactured from a specially prepared steel

made by the basic open-hearth process conforming to the following requirements as to chemical composition:

Carbon	0.65 to 0.85 per cent
Manganese	0.55 to 0.80 per cent
Silicon	0.10 to 0.30 per cent
Phosphorus, not over.....	0.05 per cent
Sulphur, not over.....	0.05 per cent

The steel is tapped into ladles and poured into ingot molds which are filled from the bottom in order to reduce the occlusion of gases and insure sound ingots. The composition of the steel is carefully controlled during the making by chemical and physical tests of each heat.

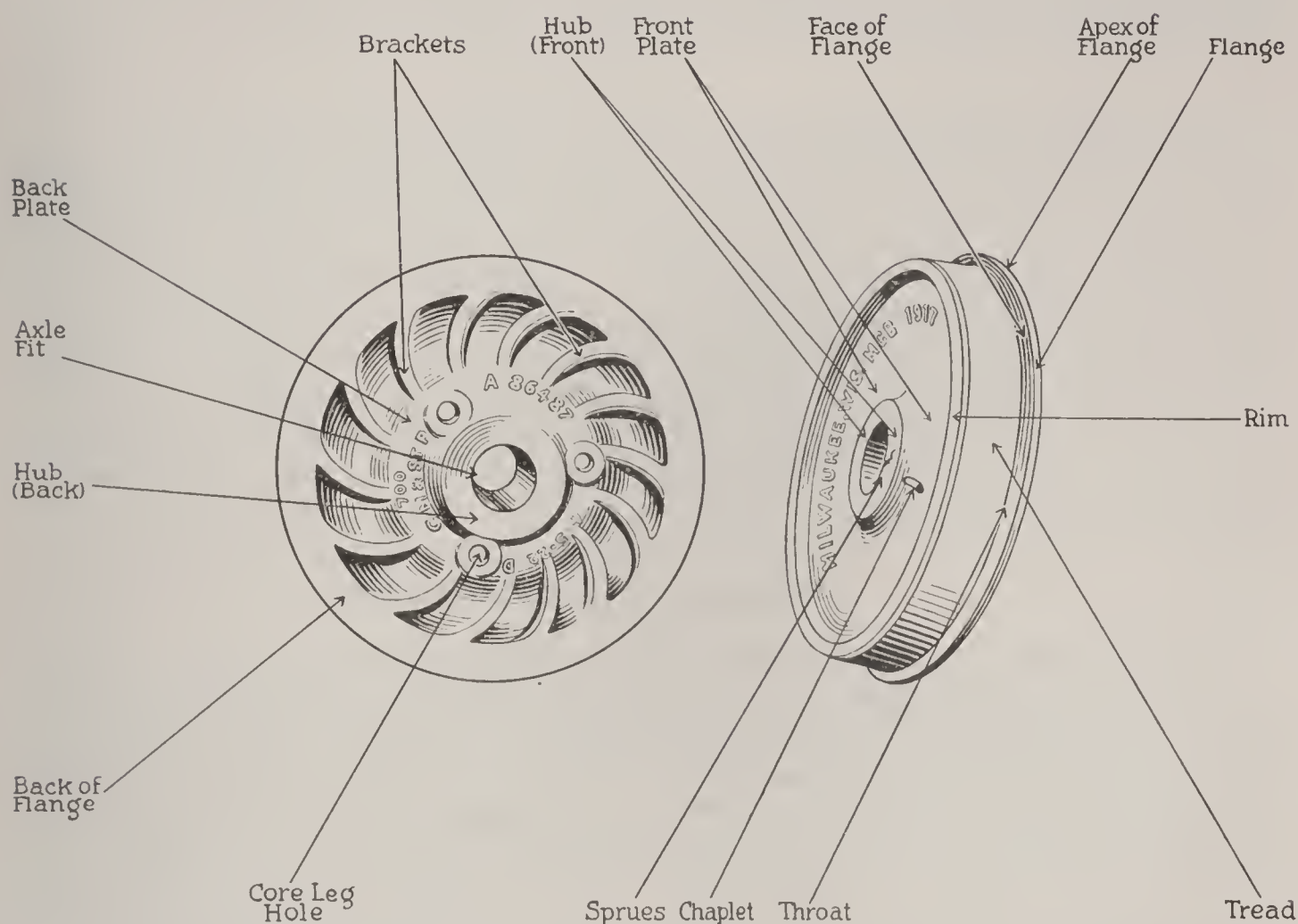
The ingots are allowed to cool and are then cut into blocks in slicing lathes, the size of the block depending upon the size and type of wheel to be made. The blocks are carefully inspected and those which pass inspection are reheated in a special type continuous furnace which brings the entire block gradually to a uniform forging heat. The block is carried to a 60,000 ton hydraulic press, where it is flattened to approximately the width of the wheel rim. The center is then punched out and the block placed in a set of dies and pressed to resemble the shape of a wheel. At this stage, it is called a blank. When the blank comes from the dies it has a hub of the correct dimensions. It is transferred immediately to the rolling mills which consist of 7 rolls from which it emerges correctly shaped.

The wheel is next transferred to a 2,500 ton hydraulic press where it is dished, giving the hub the required offset from the rim. After the wheel comes from the press, it is allowed to cool and the hub is then bored and faced and the witness groove showing the limit of wear is cut in the outside of the rim. The wheel is then measured and marked with the tape size, after which it is ready for mounting.

Rolled steel wheels are not taped in the same way as cast-iron and cast-steel, but are manufactured in certain sizes to exact measurement. They are mounted in the same way and at the same pressure as cast-steel wheels.

Steel tired wheels are made by shrinking a steel tire over a cast wheel. Other methods of applying the steel tire are by the aid of a retaining ring (similar to the manner by which a tire is fitted to an automobile), or by bolting. Mounting is the same as for other wheels, the pressures employed being those for cast iron wheels.

The descriptive parts of a car wheel are shown in the following diagram :



Further information on wheels can be obtained from the following publications:—"The Car Wheel," issued by the Brotherhood of Railway Carmen of America; "The Chilled Iron Car Wheel," by George W. Lyndon; "The Chilled Iron Wheel," by F. K. Vial, and article on Rolled Steel Wheels in the Railway Age of March 11th, 1922.

Sub-Para. (II) CLASS OF WHEEL TO BE USED

The general practice on our road is to use rolled steel wheels on the passenger train equipment, and chilled cast iron wheels under freight. However there are some exceptions covered by current circulars, but a car intended to be equipped with wrought steel, cast-steel or steel-tired wheels, and so stenciled, if found with cast-iron wheels, must be changed to proper standard, and at junction points particular care must be used by inspectors of equipment coming to use from connections and proper record and billing made.

Details of wheels are to be used under system equipment are given under "General Information."

Sub-Para. (III) WORN THIN AND WORN VERTICAL FLANGES

The office of the flange is to direct the truck, and, therefore, one flange or the other is in almost continuous contact with the rail and subject to rubbing or grinding under considerable pressure. This is especially true when traversing a curve, where the flange pressure amounts to 10,000 to

20,000 pounds under ordinary operating conditions, and impacts may, of course, momentarily double these amounts. This continuous grinding in the absence of lubrication, results in flange wear.

The limit of flange wear for cast iron wheels under freight cars of less than 80,000 capacity, is $15/16''$, gauged at a point $3/8''$ above tread. Also the wheel must be removed if the flange has a flat vertical surface extending $1''$ or more above tread. On passenger cars the flat vertical surface must not extend more than $7/8''$ above tread. Under cars of 80,000 capacity and over, the minimum flange thickness is $1''$, gauged at a point $3/8''$ above tread, while the flat vertical surface of flange must not be more than $7/8''$ in height. All steel wheels whether in freight or passenger service shall be taken out of service if the flange has a flat vertical surface extending $1''$ or more above tread, or if the thickness of the flange is $15/16''$ or less, measured at a point $3/8''$ above tread.

Sub-Para. (IV)

TREAD WORN HOLLOW

Wheels which have tread-worn hollow may be removed, but the amount of wheel which shall be worn in the tread to warrant its removal from service is left largely to the judgment of the car inspector. The idea is that wheels should be removed when worn sufficiently to permit the rim to project far enough below the top of the rail to render it liable to breakage when passing over frogs, or when the flange becomes so high that its end is likely to strike the bottom of flangeways. When wheels are worn excessively hollow, damage is done to the track at frogs and crossings on account of the overhanging rims and the high flange, which causes excessive pounding, resulting in rapid deterioration of track at these points and often track bolts are cut off. It is the practice in track work to allow a minimum of $5/8$ inch for flange clearance at the bottom of flangeways in frogs, crossings, guard rails, etc. This allows for the tread to wear down $5/8$ inch before the flange would strike frog and crossing fillings on new rails. It is customary in the heavier rail sections to allow more than $5/8$ inch below the end of the flange. This is a matter which needs attention locally to meet the daily requirements of service.

The minimum amount a wheel shall be worn hollow is not specified for freight service, but is generally conceded to be $3/16''$. (In substance, this means that the amount worn is based on the distance named below the rim. For passenger service this is to be $1/8$ inch. Wheels of ordinary taper of 1 inch in 20 inches can be worn $3/8$ inch from original contour at throat before they become $3/16$ inch hollow.)

Worn hollow is the legitimate condition of worn out wheels. In the lighter capacity cars, the percentage of wheels removed for that cause is large, while in the heavier capacity cars flange wear is greater and also all of the heat defects are in greater evidence, hence, the percentage of worn tread wheels is reduced. Wheels which crowd the rail on one side or the other should be very carefully observed. A set of suitable wheel gauges with complete instructions, will be sent to any station on the system making request for same.

Sub-Para. (V)**BRAKE BURNT WHEELS**

In brake-burnt wheels, the tread is broken up in fine hairlines running parallel to each other across the tread of the wheel, generally covering a considerable portion of the circumference.

In extreme cases the cracks may open considerably, even though no metal is broken away; this is brought about by the rapid heating and cooling of the tread over the area covered by the brake shoe.

In freight service brake-burnt wheels are developed in great numbers in sections of the country where heavy grades are most frequent and where the tonnage per effective brake is greatest. On heavy grades the brakes are applied to control the speed and therefore the action may be prolonged indefinitely. Under such conditions there is very little danger of sliding the wheels, hence the entire circumference becomes intensely heated, and when the heat becomes excessive and is generated in a sufficiently short period of time, it will cause the metal to break up into fine heat cracks, which have already been described.

In most trains there are a number of cars in which the brakes are ineffective or cut out. The effect of this is to increase the tonnage to be controlled by the remaining cars having effective brakes, and even under these unfavorable conditions there is not much danger of burning the treads of the wheels if the brake shoes are in proper position; but for various reasons the brake beam is not always central and one shoe may overlap the rim while the other crowds the flange.

The pressure on the shoe is not changed on account of its position, hence when the bearing area is reduced the pressure and the resulting heat per square inch are increased in the same proportion as the bearing area is decreased. This accounts for the number of brake-burnt rims and also for cracked flanges when the shoe bears heavily on the flange.

This condition is also quite likely to crack the plate of the wheel on account of the expansion at the rim while the tread of the wheel near the flange is cold, which produces a strong leverage, throwing the front plate into tension to such an extent as to some times cause the metal of the front plate to fracture for a distance long enough to reduce the pressure.

When a chilled iron wheel has become brake-burnt and is kept in service, the subsequent pounding disintegrates the metal which drops out little by little and results in a condition called "Comby from Brake Burn." This leaves the metal in a ragged condition, as the plane of cleavage is radial or perpendicular to the tread, and small particles of metal break off more or less irregularly.

In this connection it is well to mention slid-burnt wheels. When a wheel slides, an intense heat is generated almost instantaneously, and the metal is rapidly worn away, leaving a flat spot, often showing a fine network of haircracks around the area of the flattened surface. This condition usually appears in spots about two inches long, either singly or at various parts of the same wheel. If the slid-flat spot is not large enough to require removal and the wheel remains in service, the metal which has been disin-

tegrated by the heat may break up and drop out, resulting in a condition known as "Comby from Sliding."

Sub-Para. (VI)

SEAMS

There are two classes of seams, known as the undeveloped seam (or blue fracture) and the developed seam. The blue fracture cannot be detected until the surface metal (usually about $\frac{1}{8}$ " thick) is broken through, disclosing the seam below. This type is a foundry defect and can be avoided by pouring iron of the proper temperature in casting the wheel. The cause for undeveloped seams results from the iron when poured into the mold first filling the lower part of the hub and then traveling through the bottom plate and brackets, filling up the flange. The section of the mold forming the flange is thin and the upper part is formed by the metal chiller. It will be readily seen that the metal in the flange would be cooled somewhat by passing over the cold sand of the mold and coming in contact with the chiller. This metal is also not stirred or mixed by the subsequent metal entering the mold, as it flows on top of that which forms the flange. It is evident that the metal in the flange has already set solid and has started to contract, while the metal above the throat is still in a pasty condition, with the exception of a thin layer of surface metal which was quickly cooled by contact with the chiller. The more rapid cooling and contraction of the metal in the flange, as compared with that of the tread, tends to cause a separation, or seam. This is only true, however, where the iron when poured is not of a sufficiently high temperature to set homogeneously throughout the tread and flange section.

The second type—the developed seam—occurs in wheels of low chill, and is usually progressive, starting in small cracks in the throat which eventually unite into a line representing a crack through the chill, which may progress through the gray iron and result in a broken flange. This type can be eliminated by avoiding extremely low chill in the manufacture of wheels.

ARA rules specify that owners are responsible for seams $\frac{1}{2}$ " long or over at a distance of $\frac{1}{2}$ " or less from the throat of flange, or seams 3 or more inches long, if such seams are within the limits of $3\frac{3}{4}$ " from a point on flange $\frac{5}{8}$ " above base line. However, it has been found that undeveloped seams are *invariably of considerable length, and as they constitute a serious element of danger in train operation, and ARA rules do not demand the seam to be visible, it will be our policy to remove wheels developing longitudinal seams within the $3\frac{3}{4}$ " limit from flange which show on the surface even if only $\frac{1}{4}$ " in length.* Tests made by breaking away the flange of a wheel with a longitudinal seam have exposed seams varying from 12 to 30 inches in length, although only $\frac{1}{4}$ " to 1" showed on surface. If necessary to justify removal for purpose of ARA billing, flange may be broken off to expose the full seam.

Sub-Para. (VII) CRACKED, CHIPPED OR BROKEN FLANGE

Remove wheels with cracked flange, or chipped flange, if it exceeds $1\frac{1}{2}$ " in length and $\frac{1}{2}$ " in width. Particular attention is to be paid to chips on face of flanges, due to subsequent service causing further chipping.

Sub-Para. (VIII)**SLID FLAT WHEELS**

Freight car wheels are not considered safe for movement if flat spots are $2\frac{1}{2}$ " or more in length, or if there are two or more adjoining spots 2" or over in length. Wheel must be removed, whether spots are flat, shelled, or comby-from-sliding.

Passenger car wheels are not considered safe if spots measure 1" or more.

It is generally conceded that slid flats, comby and shelled spot are caused by wheel sliding. Sliding often occurs just before a train comes to a stop on account of greater efficiency of brake shoe as velocity of wheels decreases. Sliding over a few feet is known as skidding, and the small contact area is intensely heated, balance of wheel being comparatively cold, putting same under intense compression, being absolutely restrained around its circumference. The line of least resistance is toward center of spot extending downward into the metal sloping in all directions and receding from center. The contraction is just as rapid and the subsequent blows break out pieces of metal causing the typical shell out which resembles in appearance an inverted oyster shell.

Where wheel slides a greater distance, more metal is worn away and area of contact is increased, giving a larger area to receive the heat and the temperature is reduced accordingly. The heat in this case causes disintegration of metal, forming a net-work of hair line cracks, which subsequently break out, giving the typical "comby-from-sliding" spot.

If sliding continues over a still greater distance, a typical slid flat spot is produced, with which we are all well acquainted.

Wheels are often found that are not both affected on the same plane—that is, are not both slid-flat, comby, or shelled out—and this will be found to be due to the following conditions, either singly or in connection:—(a) Unequal pressure imposed when car is going around a curve; (b) Load unequally distributed, resulting in greater weight on one wheel than the other; (c) Variable condition of rails, such as one being dry, sandy, wet or oily, and the other say normal: the wheel skidding on an oily rail would create much less friction than the other wheel skidding on say a dry wheel, resulting in greater wear to one than the other; (d) Uneven bearing which results when one wheel crowds the rail and the other runs near rim: this makes any flat spot formed by skidding close to the throat on one wheel, but near to the rim on the other: when wheels resume normal running the former may pound the rail continuously while the other will be protected from it and possibly be eliminated altogether by the wearing action of the brake-shoe.

Sub-Para. (IX)**SHELLED OUT WHEELS**

The term "shelled out" refers to spots on the wheel where the metal has dropped out from the tread in such a way that a raised spot is left in the center, with a cavity more or less circular around it. In this case, in addition to the radial lines of cleavage there appears a holding element of the particles, making the wheel parallel to the surface of the tread, and therefore

the bottom of the defect is more or less smooth, somewhat resembling an oyster shell.

The cause of shell-outs does not seem to be as self-evident as that of comby wheels. The conditions which exist and give rise to shell-outs will, therefore, be described in detail.

The maximum air brake pressure is adjusted for the light weight of the car, hence wheels are not as likely to slide under loaded cars. Sliding often occurs just before a train comes to a standstill. This is occasioned by the greater efficiency of the brake shoe as the speed of the train decreases. The greatest frictional resistance between the wheel and the brake shoe occurs just as the wheel is about to stop revolving and often at this point exceeds the frictional resistance between the wheel and rail, in which case the wheel begins to slide. After the wheel once begins to slide, the friction between the wheel and the rail is very much lessened and sliding will continue until the brake pressure is reduced.

When the sliding is over a distance of only a few feet before the car comes to rest, the term "skidding" is applied and then a small skidded spot, the size of the area of the wheel in contact with the rail is produced.

A flat spot no larger than the contact area shown is not sufficient to cause the removal of the wheel, but the subsequent blows received in regular service very often result in the metal breaking or shelling out around the surface of this contact area, forming a shelled-out spot.

During the time the wheel is sliding all the mechanical energy represented in the resistance to motion is transferred into heat through the agency of friction; and as mechanical energy and heat are mutually convertible, the exact amount of heat generated can be easily calculated, and it is a matter of common observation that often the melting point is reached.

The size of shelled out spots which will condemn a wheel are covered by previous sub-para.

**Sub-Para. (X) BROKEN OR CHIPPED RIMS OR
TREAD**

Broken or chipped rims, if such that tread measured from the flange at a point $\frac{5}{8}$ " above rim or tread is less than $3\frac{3}{4}$ " in width, or if the bearing face of tread or rim which may engage the top and exposed face of the rail is less than $3\frac{1}{4}$ inches wide, will cause wheel to be condemned.

Sub-Para. (XI) WHEELS WORN THROUGH CHILL

The defect known as worn-through chill often cannot be discerned by the appearance of the tread and manner in which it is worn. If worn irregularly, that is, deeper at some places than at others, or if worn flat, it is evident that it has worn through the chill. Wheels seldom wear through the chill all around the tread at the same time; therefore, when a wheel is worn evenly, no matter how deeply, or shows the shape of the rail all the way around (commonly termed "railworn"), and has no appearance of being worn flat at any place, there is a good reason to question whether it has worn through the chill. This can be determined by polishing the tread with

emery cloth, breaking off the flange with a sledge, denting the tread with a chisel, or breaking the wheel. When the first method is used, if a few small black dots of graphite can be seen, the wheel is just starting to wear through the chill. If the graphite shows plainly, it is well worn through the chill.

A method in vogue with some railroads is to dent the tread with a chisel, and if the chisel makes a deep mark without blunting its edge, the wheel undoubtedly is worn through the chill.

Sub-Para. (XII) WHEEL LOOSE ON AXLE OR OUT OF GAUGE

Wheels are out of gauge if less than 5 feet 4 inches over the outside edges of the rim or 4 feet 5 $\frac{1}{4}$ inches between inside edges of rim (flanges back to back). For wheels cast after 1907 the distance 4 feet 5 $\frac{3}{32}$ inches will govern. Maximum check gauge distance is 4 feet 6 $\frac{3}{4}$ inches for wheels cast prior to 1906 and 4 feet 6 $\frac{29}{64}$ inches for those cast subsequent to 1907.

Sub-Para. (XIII) BURST WHEELS

If the wheel is cracked from the wheel fit, outward by pressure from the axle, it should be immediately removed from service.

Sub-Para. (XIV) THICK FLANGES

When placing new wheels under cars, care should be taken to see that the maximum thickness of flange permitted does not exceed 1-19/64", measured at a point 5/8" above tread.

Sub-Para. (XV) SHOULDER WORN

Occasionally a wheel does not play laterally, resulting in the flange of one wheel not making contact with the rail, consequently forming a shoulder near the flange. This is commonly known as "Shoulder Worn" or "Double Flange," and where this appears decisively in a wheel, it should be removed.

Sub-Para. (XVI) CRACKED TREADS, PLATES OR BRACKETS

Too much care cannot be exercised by inspectors to locate cracked plate wheels, as they are a source of tremendous danger in service. The primary cause of cracked-plate wheels is an expansion stress, due to sudden heating of the tread while the plates are cold. When the brakes are applied continuously, a rapid expansion takes place in the metal of the tread, which produces a strong tensile stress on the plates. Usually the heating is more severe toward the rim, and, therefore, there is a greater stress on the front plate than on the back plate.

In addition to the temperature stresses, the flange pressure reacts on the plates, producing a tensile, or pulling stress, on the front plate, and a compression on the back plate, hence the combination of stresses on the back plate tend to equalize each other.

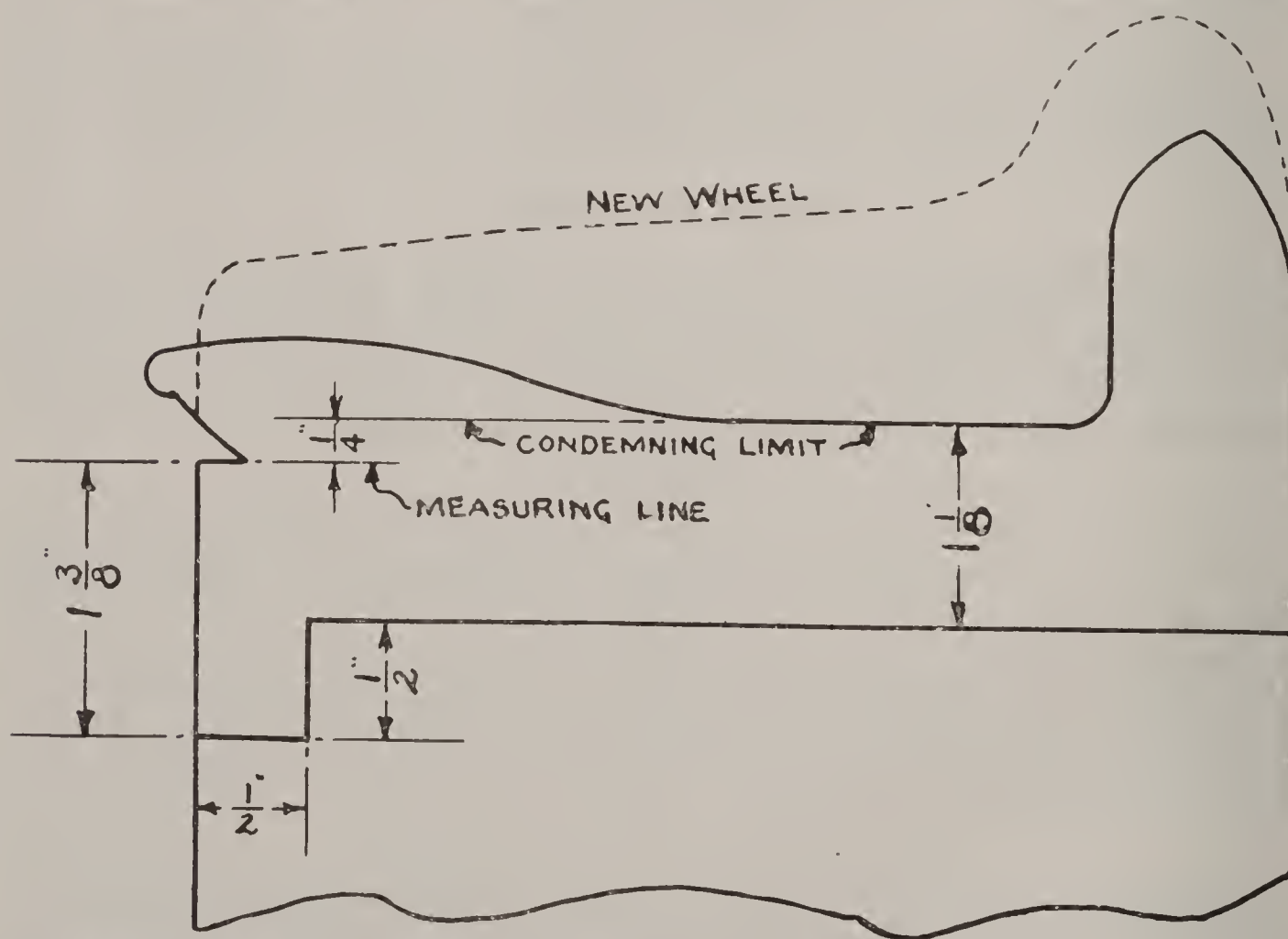
Cracked treads and brackets are generally due to the same cause. The wrong position of a brake shoe is often responsible for the sudden heating referred to. When a shoe runs on the rim the bearing area is materially decreased, causing greater heat and resulting in the unequal expansion described.

**Sub-Para. (XVII) CRACKED HUBS ON STEEL
TIRED WHEELS**

Steel tired wheels with broken or cracked hubs, plates, bolts, retaining ring or tire, should be removed.

**Sub-Para. (XVIII) LIMIT OF WEAR OF STEEL
TIRED WHEELS**

There are not many of these wheels in service, and records do not indicate on what equipment used. The condemning limit of tire thickness is $1\frac{1}{8}$ ", but to be able to measure this it is necessary to know that a lip is sometimes provided on these tires to prevent their working inward. This lip is *usually* $\frac{1}{2}$ " deep. If measurement is taken from bottom of lip, failures will result. When a tire is fitted the shop doing the work must put a witness groove or measuring line on the outside of tire, $\frac{1}{4}$ " below the condemning limit, in accordance with blue print issued with M. E. Circular letter 1008. Inspectors will see that wheels are taken out of service when they wear within $\frac{1}{4}$ " of this witness groove, and should a steel tired wheel be discovered that discloses no witness groove, it is to be presumed it has been allowed to remain in service beyond its limitations, resulting in the groove wearing away, and the wheel must be ordered out of service at once.



**Sub-Para. (XIX) LIMIT OF WEAR OF ROLLED
STEEL WHEELS**

ARA Rules provide that rolled steel wheels (33") are not to be turned down to a point where the diameter is less than $29\frac{1}{2}$ ". Accordingly wheels are marked with a witness groove placed $\frac{1}{4}$ " below the condemning limit, and as soon as wheel wears within $\frac{1}{4}$ " of this groove it must be ordered out of service.

Rolled steel wheels removed from foreign cars will be gauged as laid down in Standard Practices (Section 4), so records in regard to service metal after turning down may be completed to permit of ARA billing.

In ascertaining amount of service metal it must be noted *the bottom side of witness groove* represents the line from which to measure. (See sketch above).

**Sub-Para. (XX) MARKING WHEELS WHEN
REMOVED FROM EQUIPMENT**

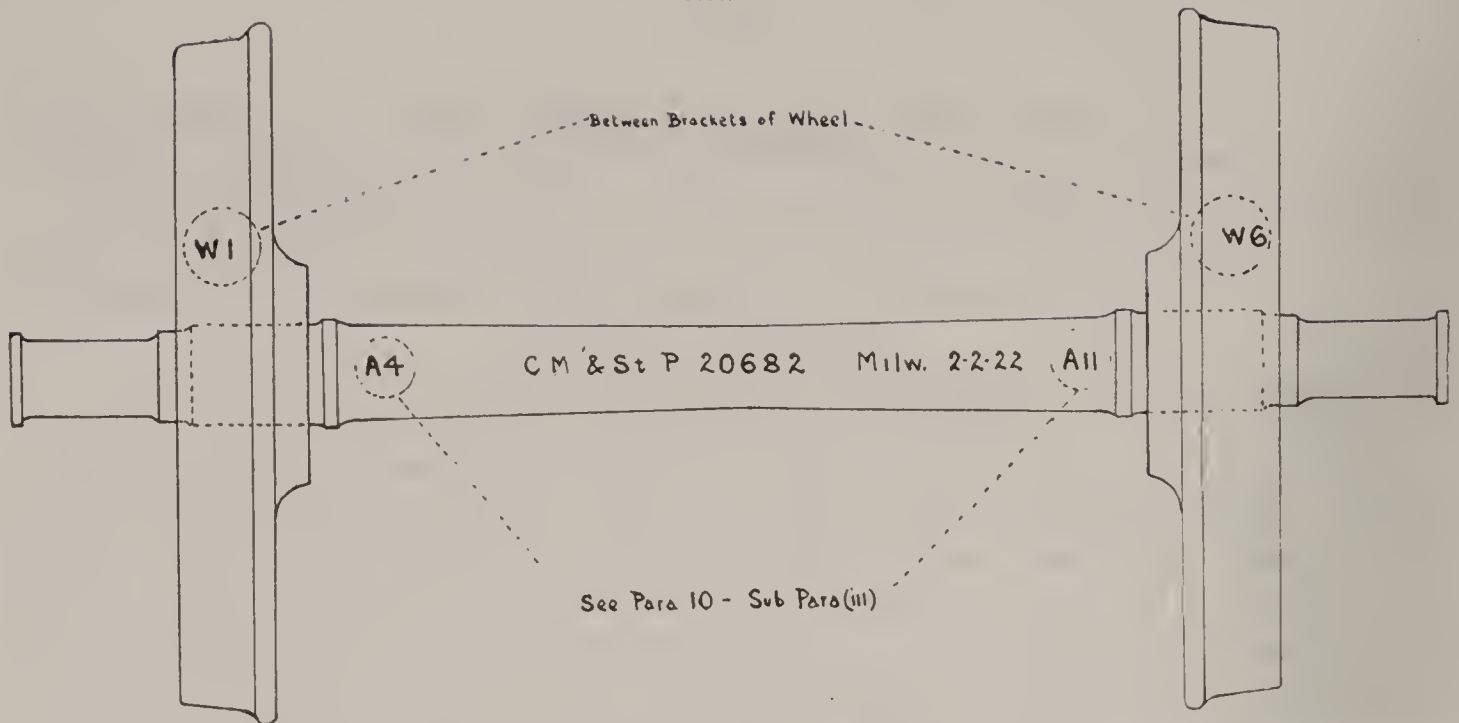
It sometimes occurs that wheels are removed from cars unnecessarily, and in order to guard against this, and to check other irregularities, men are located at Milwaukee, Dubuque, Chicago, Terre Haute, Green Bay, Minneapolis, Miles City, Deer Lodge, Spirit Lake and Tacoma Shops, whose duty it is to go over every pair of wheels sent in off the railroad, and make note of and follow up any condition which should not exist.

In order to provide for this arrangement, all stations are to whitelead the axle of every pair of wheels removed, showing defect symbol, car initial and number, station, and date. This is to be done daily at big points, and at small places the information should be chalked on axles so that it will not be washed off, and then whitelead at convenient times. Whiteleading should not be left over indefinitely, but the work done at the first opportunity.

The method of marking will be as shown in the following sketch, and the symbols for defects as set out below will be used:—

Symbol	Wheel Defect
W 1	All right for service
W 2	Bracket cracked
W 3	Brake-burnt
W 4	Burned from fire
W 5	Chill worn through
W 6	Flange broken
W 7	Flange chipped
W 8	Flange worn thin
W 9	Flange worn vertical
W 10	Hub burst
W 11	Hub worn
W 12	Large axle fit
W 13	Loose wheel
W 14	Plate cracked—front
W 15	Plate cracked—back
W 16	Rim broken
W 17	Rim chipped
W 18	Seamy
W 19	Shelled-out
W 20	Shoulder worn
W 21	Slid-flat
W 22	Tread cracked
W 23	Tread worn hollow
W 24	Wheel broken in pieces

(For axle symbols, see para. 10, sub-para. 3.)



When scrapped wheels are received at Milwaukee, they will be further inspected, and any found fit for service are to be reported to the Master Car Builder's office, stating point from which received.

Sub-Para. (XXI) VARIATION IN SIZES OF STEEL WHEELS UNDER PASSENGER CARS

The Rolled steel wheels in use under our passenger cars are 33" and 36" in diameter when new. They may be turned down to a defined limit, which causes some variation in sizes. In changing wheels under a passenger car it is important that this variation between wheels already in the truck and those replaced be not too pronounced, and it is therefore laid down that the difference in height of wheels is not to exceed one inch. That is to say, the height from top of rail to top of wheels in the same truck shall not vary more than one inch.

This rule will be observed in all cases other than in emergencies, where wheels of the required size are not available.

If the 1" variation has to be exceeded, however, the higher wheels must not be applied in center of trucks, but a change over made so the smaller wheels will be in center.

Sub-Para. (XXII) GUARANTEE ON CAST IRON WHEELS

We have a guarantee on cast iron wheels purchased from private manufacturers, on the following basis.

Capacity	Axle	Dia. of wheel	Weight of wheel	Guaranteed
60 M	4 $\frac{1}{4}$ x8	33"	625/650 Lbs.	6 years
80 M	5 x9	33"	700 Lbs.	5 years
100 M	5 $\frac{1}{2}$ x10	33"	725/750 Lbs.	4 years

The guarantee dates from time of casting (shown on wheel), and covers manufacturers defects.

When wheel bearing in addition to the name of the manufacturer, the initials C. M. & St. P. R. R. are taken out of service, the casting date is to be noted, and if the above guarantee has not been met, the matter will be reported by letter through the usual channels. Such defective wheels will be stencilled REPLACEMENT in white lead. When received at shop points they are to be held for inspection, if practicable in pairs on axles, but if conditions are such that axles are required for immediate use wheels may be pressed off, *excepting in case of a shelled out wheel* (one wheel only shelled out).

The following would constitute "manufacturer's defects"—Chill worn through; flange broken when due to seams; shelled spots when not in pairs; rim broken or chipped; seams; tread cracked if not account overheating, and tread worn hollow. Inspectors removing wheels due to any of these defects occurring within the guarantee period should mark wheel "Replacement" as stated, but the actual replacement by manufacturers will depend upon a joint inspection, for which purpose wheels will be held at shop points as described.

**Sub-Para. (XXIII) TURNING DOWN SHARP FLANGE
STEEL WHEELS**

When it is necessary to turn rolled steel (or steel tired) wheels on account of one wheel having a sharp flange, the following procedure is to be adopted.

The sharp flanged wheel will be turned to the *minimum* flange thickness permitted by A. R. A. rules,—diameter to remain $1/32$ " greater than the other wheel on same axle. The mate wheel will be turned to *maximum* flange thickness permitted by A. R. A. rules.

By this practice the turning away of considerable good wearing metal on tread of tire is avoided, and it will generally be found that at the next turning both wheels can be restored to full flange.

Para. 10. AXLES

Sub-Para. (I) GENERAL INFORMATION

Axles are very carefully manufactured from steel made by the Open Hearth Process which conforms to the following requirements for chemical composition:—

Carbon	0.38—0.52 percent
Manganese	0.40—0.60 percent
Phosphorus, not over.....	0.05 percent
Sulphur, not over.....	0.05 percent

The most important factor is the uniformity of material and in order to obtain this, great care is exercised in passing the metal thru continuous furnaces which feed automatically. The steel is worked and reworked constantly to such an extent that molecular action takes place and molecules of steel are brought together so closely that at the completion of the operation the axle or forging contains a homogeneous mass, forming a finely-grained product which has been forged down to a common center, giving a uniformity of material and assuring the fundamental parts as a factor of safety.

The usual strains that result in steel as the outcome of uneven cooling, due to expansion and contraction and unequal temperature, are eliminated or modified by annealing or heat treating the axle.

The completed axle is subjected to a drop test in accordance with the requirements of A. R. A. specifications. One drop test is made from each melt and if this fails, all axles from that melt are rejected. Each axle is then subjected to a rigid surface inspection.

**Sub-Para. (II) CALIPERING AXLES REMOVED
AND APPLIED**

There is no direction in which greater care is necessary than in the calipering of axles removed and applied. This will be evident upon examination of the attached table which shows that there are four classifications into which every A. R. A. axle may fall, as follows:—(1) New, (2) Second-hand, (3) Considered scrap for M. C. B. billing, (4) Scrap. The requirements in each instance are quoted below:—

Car Capacity	A		B	C	D		E
	Classification Axle	Diameter of Journal	Length of Journal	Thickness of Collar	Diameter of Center of Axle	Diameter of Wheel Seat	
40 M	New.....	3 $\frac{3}{4}$ " min.	7" max.	$\frac{5}{8}$ " min.	4 $\frac{1}{4}$ " min.	5 $\frac{1}{8}$ " min.	
	Second Hand.....	Not less than	Not more than	Not less than	Not less than	Not less than	4 $\frac{7}{8}$ "
	Considered Scrap for MCB billing.....	Anything less than 3 $\frac{3}{8}$ "	Anything more than 7 $\frac{3}{8}$ "	Anything less than 7 $\frac{1}{2}$ "	$\frac{5}{16}$ "	Anything less than 4 $\frac{3}{16}$ "	Anything less than 4 $\frac{7}{8}$ "
	Scrap (to be taken out of service.)	3 $\frac{1}{4}$ "			$\frac{1}{4}$ "	Anything less than 4 $\frac{3}{16}$ "	Anything less than 4 $\frac{7}{8}$ "
60 M	New.....	4 $\frac{1}{4}$ " min.	8" max.	$\frac{5}{8}$ " min.	4 $\frac{3}{4}$ " min.	5 $\frac{3}{4}$ " min.	
	Second Hand.....	Not less than	Not more than	Not less than	Not less than	Not less than	5 $\frac{1}{2}$ "
	Considered Scrap for MCB billing.....	Anything less than 3 $\frac{7}{8}$ "	Anything more than 8 $\frac{3}{8}$ "	Anything less than 8 $\frac{1}{2}$ "	$\frac{5}{16}$ "	Anything less than 4 $\frac{11}{16}$ "	Anything less than 5 $\frac{1}{2}$ "
	Scrap (to be taken out of service)	3 $\frac{3}{4}$ "			$\frac{1}{4}$ "	Anything less than 4 $\frac{11}{16}$ "	Anything less than 5 $\frac{1}{2}$ "
80 M	New.....	5" min.	9" max.	$\frac{3}{4}$ " min.	5 $\frac{3}{8}$ " min.	6 $\frac{1}{2}$ " min.	
	Second Hand.....	Not less than	Not more than	Not less than	Not less than	Not less than	6 $\frac{1}{4}$ "
	Considered Scrap for MCB billing.....	Anything less than 4 $\frac{5}{8}$ "	Anything more than 9 $\frac{3}{8}$ "	Anything less than 9 $\frac{1}{2}$ "	$\frac{5}{16}$ "	Anything less than 5 $\frac{1}{4}$ "	Anything less than 6 $\frac{1}{4}$ "
	Scrap (to be taken out of service)	4 $\frac{1}{2}$ "			$\frac{1}{4}$ "	Anything less than 5 $\frac{1}{4}$ "	Anything less than 6 $\frac{1}{4}$ "
100 M	New.....	5 $\frac{1}{2}$ " min.	10" max.	$\frac{3}{4}$ " min.	5 $\frac{7}{8}$ " min.	7" min.	
	Second Hand.....	Not less than	Not more than	Not less than	Not less than	Not less than	6 $\frac{3}{4}$ "
	Considered Scrap for MCB billing.....	Anything less than 5 $\frac{1}{8}$ "	Anything more than 10 $\frac{3}{8}$ "	Anything less than 10 $\frac{1}{2}$ "	$\frac{5}{16}$ "	Anything less than 5 $\frac{3}{4}$ "	Anything less than 6 $\frac{3}{4}$ "
	Scrap (to be taken out of service)	5"			$\frac{1}{4}$ "	Anything less than 5 $\frac{3}{4}$ "	Anything less than 6 $\frac{3}{4}$ "
140 M	New.....	6" min.	11" max.	$\frac{7}{8}$ " min.	6 $\frac{1}{16}$ " min.	7 $\frac{5}{8}$ " min.	
	Second Hand.....	Not less than	Not more than	Not less than	Not less than	Not less than	7 $\frac{3}{8}$ "
	Considered Scrap for MCB billing.....	Anything less than 5 $\frac{5}{8}$ "	Anything more than 11 $\frac{3}{8}$ "	Anything less than 11 $\frac{1}{2}$ "	$\frac{5}{16}$ "	Anything less than 6 $\frac{5}{16}$ "	Anything less than 7 $\frac{3}{8}$ "
	Scrap (to be taken out of service)	5 $\frac{1}{2}$ "			$\frac{1}{4}$ "	Anything less than 6 $\frac{5}{16}$ "	Anything less than 7 $\frac{3}{8}$ "

In calipering a cut journal, the measurement to be quoted will be the diameter of the journal at unaffected area, *less twice the depth of the cut and 1/32 inch to provide for turning down.*

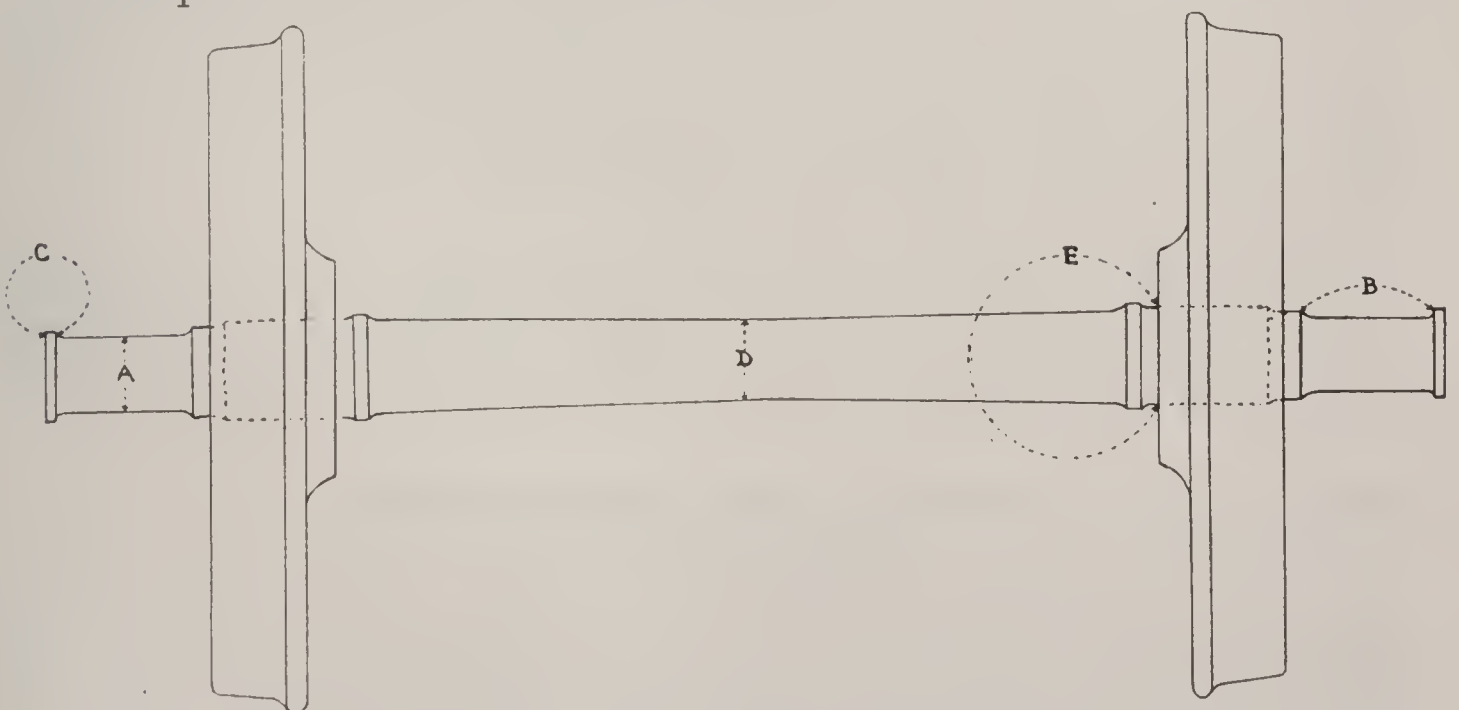
The following table shows the limits of wear for non-ARA axles, and where they are found in service must be removed unless these measurements can be complied with:—If removed for any reason, they will be credited as scrap, whether they have reached condemning limits or not.

Car Capacity	A Dia. of Journal	B Length of Journal	C Thickness of Collar	D Dia. of center of axle	E Dia. of wheel seat
40M	3 $\frac{1}{4}$ " min.	7 $\frac{1}{2}$ " max.	Condemming limit $\frac{1}{4}$ "	3 $\frac{7}{8}$ " min.	4 $\frac{5}{8}$ " min.
50M	3 $\frac{1}{2}$ " min.	8" max.	Condemming limit $\frac{1}{4}$ "	4 $\frac{1}{8}$ " min.	4 $\frac{3}{4}$ " min.
60M	3 $\frac{3}{4}$ " min.	8 $\frac{1}{2}$ " max.	Condemming limit $\frac{1}{4}$ "	4 $\frac{3}{8}$ " min.	5" min.
70M	4" min.	8 $\frac{3}{4}$ " max.	Condemming limit $\frac{1}{4}$ "	4 $\frac{7}{8}$ " min.	5 $\frac{5}{8}$ " min.
*100M	5" min.	9 $\frac{1}{2}$ " max.	Condemming limit $\frac{1}{4}$ "	5 $\frac{7}{8}$ " min.	6 $\frac{7}{16}$ " min.

* This axle, provided with 5 $\frac{1}{2}$ "x9" journal (new) is only permitted for a limit load (total weight on rail) of 148,000 lb., provided, however, in the event of removal of wheels, it will be permissible to replace this axle with Standard A. R. A. 80,000-lb. capacity axle having 5 in. by 9 in. journals; in which case the car shall be restenciled to the limit load marking of 132,000 lb., or nominal capacity of 80,000 lb. The car owner will be responsible for the expense of this change, except that in case of delivering line defects the charge against owner shall be confined to the difference in value between the non-A. R. A. Standard axle removed and the A. R. A. Standard axle applied. In case of such change in axle and stenciling of car, owner shall be promptly notified.

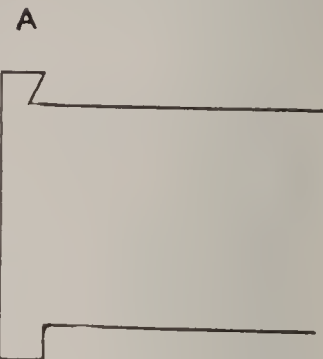
[Note: Non-A. R. A. axles may be replaced in kind. A wornout A. R. A. axle may be replaced by a non-A. R. A. axle of same capacity provided a defect card is issued to cover it, which should not be done except in case of material shortage. An A. R. A. 60 M axle having wheel seat less than requirements, but still above the requirements of a non-A. R. A., may be replaced in kind, or may be used until January 1st, 1924 to replace non-A. R. A. axle. The application of non-A. R. A. axles, either to our own or foreign equipment, is poor practice, and is to be eliminated as soon as possible.

The points at which measurements are to be taken are shown below:



The need for careful calipering is seen by observing the slight variations in the different classifications. Many thousands of dollars can be saved the Company each year by Foremen taking positive steps to see that the

necessary care in calipering and recording is shown. Inspectors must *caliper both journals*, and where any variation is found the least favorable measurement will be quoted.* In this connection collars worn as per sketch shown must show thickness of collar at smallest measurement, and length of journal as from the extreme top of shoulder near wheel (observe the sketch showing calipering points) to a point on collar directly above most worn section, as shown by letter A. Similarly any cut on the portion of the axle between wheel and wheel, such as would be caused by the brake rod being in contact, must be shown as “center of axle” measurement, if its diameter at that point is less than at center.



In calipering wheel seat, the measurement is best taken from inside—that is, between the wheels—This is because of the possibility of wear of the wheel seat on the journal side, due to sand and grit accumulating on the dust guard. Also it is sometimes a practice in our own and other shops to turn down slightly the first $\frac{1}{4}$ inch or $\frac{1}{3}$ inch of wheel seat to simplify getting wheel in position when mounting. On axles of wheels mounted in our own shops no difficulty will be found in calipering wheel seat on the inside, as axle is always turned down at wheel seat for some distance more than is actually required, but on axles of foreign mounted wheels there is often a sharp shoulder so close to wheel that it is impossible to caliper the wheel seat excepting on the outside (journal side). In such cases care should be taken to measure both journals, avoiding worn areas, and if any variation is found *quote the larger dimension*, (this being the only exception to the above rule, marked *) .

In taking axle measurements a rule marked to thirty seconds of an inch must be used. When collar of journal approaches the condemning limit A. R. A. wheel gauge is to be used for taking the measurement. By the term “anything less than” is meant the finest possible measurement—the breadth of a hair. A 60 M journal measuring a hair breadth less than $3\frac{7}{8}$ ” in diameter would be scrap. Measurements should be clearly written down as soon as taken, so as to permit of no possible error.

ARA Standard axles must be used in replacing A. R. A. axles subject to condemning limits for such axles. A. R. A. Standard axles will be used to replace non-A. R. A. axles at the expense of the car owner excepting in the case of delivering line defects.

Sub-Para. (III) MARKING AXLES WHEN REMOVED FROM EQUIPMENT

In order to guard against incorrections and irregularities in handling axles removed from service, the men located at Milwaukee, Dubuque, Chicago, Terre Haute, Green Bay, Minneapolis, Miles City, Deer Lodge and Tacoma Shops that inspect removed-wheels, will examine all axles, and where any wrong classification is found, it will be reported to the Master Car Builder.

In order to permit of this being done, all axles removed are to be marked in accordance with the following symbols:

Place to Left of Car Num- ber	{	A 1 .....New
		A 2 .....Secoud Hand
		A 3 .....Considered scrap for MCB billing
		A 4 .....Scrap
Place to right of Car Num- ber	{	A 5 .....Axle bent
		A 6 .....Axle burned from fire
		A 7 .....Axle wrong size
		A 8 .....Collar broken
		A 9 .....Collar worn
		A 10.....Fillet sharp
		A 11.....Journal cut
		A 12.....Journal long
		A 13.....Journal small
		A 14.....Journal tapered
		A 15.....Journal wrong size
		A 16.....Small axle center
		A 17.....Small wheel seat
		A 18.....Seam crack or flaw

(See sketch under Para. 9 sub-para. (9))

Sub-Para. (IV) EXAMINATION AND CARE OF AXLES

It will be observed by reference to the list of axle defects set out in previous sub-paragraph, that A-6—Axle burned from fire, A-11—Journal Cut, and A-18—Seam Crack or flaw, cannot be determined by measuring and calipering. Examination of the axle is necessary.

If an axle has become overheated, resulting in the packing burning and the journal getting red, and upon examination it is thought the axle has spoiled, or an axle is removed from a burned car, it will be marked A6.

A cut journal will be readily observed, and the axle marked accordingly.

Axles must be closely inspected for seams, cracks or flaws. Seamy journals may be returned to service if seams can be removed by turning within the required limits. Cracked or flawed axles should be tested by painting doubtful parts with white lead paint, and then holding a flatner on end of journal and striking with a sledge; oil working through paint will indicate flaw. Axles exhibiting cracks, flaws, or showing signs of excessive overheating must be scrapped.

Mounted wheels held in readiness for placing under cars should have journals very carefully preserved. Wheels should be so placed that flanges will not strike journals. The journals must be coated with either white lead or thick oil, so as to prevent rusting. When a journal is found that has rusted, it can be cleaned off with sandpaper, but a file or emery paper must not be used.—This also applies to the removal of white lead.

Wheels should, as far as possible, be stored on wood or else on rails. All wheels should be kept off of cinders, but steel wheel positively must be.

Para. 11**BRAKES****Sub-para. (I) GENERAL OUTLINE AND PURPOSE
OF BRAKES**

During recent years railroads have devoted a great deal of time and study to brakes, because it has come to be realized that efficiency in braking power is an economic feature in train operation.

Brakes not only act as a guard against danger to passengers, the crew, and the public, but protects the equipment and lading against damage. This condition obtains on every railroad in the country, but applies in an exceptional way on our own railroad, where, in certain areas, we have very heavy grades to descend, arduous geographical territory to negotiate, and operating conditions fraught with many difficulties.

Brakes may be said to consist of two parts—air brake equipment, and foundation brake rigging. The former is that part of the braking system whereby the power of force represented by the air compressed on the locomotive and stored in a reservoir under each car, is transmitted by means of valvular mechanism and brake cylinders to the latter or system of brake levers known as the brake rigging, resulting in the application of the brake shoes to the wheels. The principle on which the air brake operates is to build up an air pressure in an auxiliary reservoir, which pressure, if allowed to function will immediately apply against a piston in the brake cylinder forcing it forward, applying the brakes. To apply the brakes all that is necessary is to reduce the pressure in the brake train line air pipe, which can be done by opening it at any point. To obtain release the pipe line pressure must be built up, and as soon as this becomes greater than that remaining in the auxiliary reservoir, the air in the brake cylinder is allowed to escape, and the brakes release.

Various air brakes have been evolved and are in use on different classes of equipment. The variations are to take care of certain operating features or to cope with conditions imposed by peculiarities in equipment construction.

The foundation brake rigging for each car or class of equipment is decided upon as the result of study, and detailed specifications are issued to all concerned, so that in the repair, renewal or application of any part or parts, the correct size, dimension, and required strength may be applied. Every repair point must be in possession of such information.

The need for correct levers and rods being used on cars and all parts of the foundation being securely and correctly applied and maintained, cannot be too strongly impressed upon all concerned. The failure of any part of the foundation brake rigging will defeat the whole purpose of the brake.

**Sub-para. (II) RESPONSIBILITY FOR AIR TESTS
AND BRAKE CONDITIONS**

In some cases it has been found that a belief exists that the responsibility for air brake conditions does not belong to the car department.

This is entirely erroneous and it should be very clearly understood that we are responsible for the condition of both the air brake equipment and foundation brake rigging on all cars—freight and passenger, revenue and non-revenue, and on all tenders, operating on our road. Air brake men will receive instructions, assistance and information from the Air Brake Supervisor, but it is the car foreman who will be held responsible for the work of testing, inspecting, repairing and maintaining brakes. On this account foremen must acquaint themselves with the duties of those entrusted to handle brakes and must be sufficiently well versed in the work to be able to intelligently supervise and handle the matter.

In this connection any information concerning brakes not contained in this paragraph may be obtained by writing direct to the Master Car Builder, and any publications on air brakes desired in connection with the work or supervision of the work will be supplied upon proper request.

The responsibility for brake conditions includes that of making air tests on all outgoing trains—freight and passenger—and car foremen must insure that the necessary tests are made as laid down in this paragraph, by competent air men where available, otherwise by car inspectors or by the foreman personally. The only exceptions will be those points where local arrangements are for the train crews to make the tests.

Sub-para. (III) EXPLANATION OF TERMS

In order to more readily explain what is required in connection with the testing and repairing of brakes the following terms are set out for information:

Braking power, or, properly termed, braking force, is the brake shoe pressure or force holding the brake shoe against the wheel.

Per cent braking power, or, properly termed, braking ratio, is the ratio between the brake shoe pressure or braking force and the empty weight of the car.

By *piston travel* is meant the distance the brake cylinder piston moves out when the brake is fully applied. To measure piston travel, first be sure that the head is bottomed in the cylinder, making a mark on the piston rod at the edge of the cylinder head and then note the distance the piston travels out when the brakes are applied. *Standing travel* is the distance piston is forced out in an application of the brake upon a car when not in motion. *Running travel* is the distance the piston is forced out when applying the brake on a car in motion and is always greater than the standing travel. *False travel* is the piston travel obtained in excess of that required merely to bring the shoes against the wheels. It is closely allied with the difference between running and standing piston travel. The excessive travel being due to slack in loose fitting brasses, to shoes pulling down on the wheels, to play between boxes and pedestals and to everything of a similar nature that increases lost motion in the brake rigging under the influence of the motion of the car. The brake cylinder pressure resulting from a brake pipe reduction is greater with a short than with a long piston travel.

A piston travel of 8 inches should result from a brake cylinder pressure of 50 pounds in a full service application. (Auxiliary reservoirs are so proportioned that they will equalize with the brake cylinder at 50 pounds if the piston travel is correctly adjusted to 8 inches running.) Inasmuch as running travel is generally about 1 inch greater than standing travel, *the standing travel should be 7 inches* to secure this result while running. If the piston travel is *shorter* than 8 inches, the air of the auxiliary reservoir and brake cylinder will equalize at a higher pressure and the brakes will be applied much harder. If the travel is *more* than 8 inches, the air of the auxiliary reservoir and brake cylinder will equalize at a lower pressure and the brakes cannot be applied nearly as hard. On passenger cars *having automatic slack adjusters*, the standing piston travel is to be adjusted to 7½ inches (instead of 7 inches), due to the fact that high brake cylinder pressure is obtained with light initial brake pipe reductions. This condition is aggravated where the piston travel is shorter than specified.

Slack Adjuster, is a device for maintaining uniform piston travel by taking up excessive brake shoe clearance due to shoe wear or tire turning. Automatic slack adjusters are generally and properly used to care for shoe wear while manual or hand slack adjusters of various types are used for tire turning, angularity adjustment, shoe wear, etc.

Foundation Brake Rigging is the lever and rod system, including the brake beams, hangers, etc., through which the brake cylinder force is increased, transmitted and distributed to the several wheels under a car.

Harmonious Hand and Air Brake is a brake rigging in which the forces of the hand brake and air brake are exerted in the same direction so that if either the hand or air brake is applied and the other is added they will operate together.

**Sub-para. (IV) OUTGOING INSPECTION OF BRAKES
ON FREIGHT CARS IN TRAINS,
WHEN MADE BY OTHER THAN
AIR BRAKE MEN**

When a train is made up ready to depart and there is air available from pipes the inspectors will connect the air to the cars and allow it to flow in enough to charge up the brake pipe. Under no circumstances are the train brakes to be charged higher than 70 lbs., and where the pressure in the yard line is known to be greater than this, precautions must be taken to insure that train is not charged above standard pressure (70 lbs.), otherwise the engine may not be able to release brakes, and inspectors will also be deceived as to piston travel. Inspection will then be made along the entire length of the train for air leaks and during this inspection as many leaks as possible should be rectified, and a smart inspector carrying a Stillson wrench and a good supply of gaskets can remedy many leaks along a train, which, individually, may not appear to amount to anything significant, but collectively make a great deal of difference to the operation of the train.

As soon as the inspection for leaks is completed the air from the yard pipe line should be shut off and a reduction sufficient to set the brakes

throughout the train made. Inspection will be made immediately to see that all brakes have applied and that piston travel is correct. Inoperative brakes, with which nothing can be found wrong other than that they do not apply will not be cut out and carded. They are, however, to be noted for inclusion on the 975 report as inoperative brakes. Cars found in any condition which will make it necessary to cut out the brake will be carded and noted on the 975 report. In this connection it should be observed that wherever possible brakes should be repaired on cars before they are allowed to proceed, and unless competent men are available who can attend to the matter the inspector should cut the brake out, but good judgment must be used taking into consideration the class of loading, etc.

In yards where air is not available the test will be made by means of a switch engine for the purpose of pumping up and setting the brakes, otherwise it cannot be made until the regular engine has backed on. If commencing the inspection at the rear of the train the angle cock should be opened very slightly to ascertain that the air is coming through, and then closed. Inspection for leaks will then be made and when the engine is reached the engineer requested to apply the brakes. Inspection will then be made for piston travel and ineffective brakes, and upon reaching the caboose 975 report handed to the conductor, and in addition he should be informed verbally of the number of cut-outs or inoperative brakes he has in his train.

In all cases as trains depart it should be observed that brakes have been released. If the brakes of a car are sticking the inspector will endeavor to obtain release by pulling on the release rod, but if this fails the train must be stopped and the situation corrected or brakes cut out.

**Sub-para. (V) INSPECTION OF BRAKES ON FREIGHT
CARS IN TRAINS WHEN MADE
BY AIR BRAKE MEN**

Where air brake men are employed in yards, both an incoming and outgoing test is to be made of all freight trains. The incoming test is to locate any brake trouble requiring attention so they may be taken care of before the cars depart in other trains, and the outgoing test to establish positively that not less than 85% of the brakes are operative.

On arrival of incoming trains at terminals, inspectors should see that locomotive is not cut off until a 20 pound reduction of brake pipe pressure has been made by the engineman, which will be indicated by a short whistle.

When a train must be cut and left on two or more tracks the 20 pound reduction must be completed and whistle blast signal given before cutting off from each section of the train. Angle cocks must not be closed until this application is completed and signal received.

Inspection should be commenced without delay and be completed within 10 minutes if possible, otherwise brake cylinder leakage will make the test unduly severe. Defects found will be chalk marked as follows:

- O Shows that brake either leaked off or did not apply.
- Incorrect piston travel, numeral after dash gives length as —10 meaning piston has travel of 10 inches.
- + Car has brakes cut out.
- ✓ Leaky connection at triple valve.
- R Defective retainer pipe.
- ⊕ Bottom brake rod too long.
- × Cross made on both hose couplings denotes leaky gaskets.

A chalk mark the entire length of hose, shows hose defective.

Repair work will not be attempted until after completion of inspection.

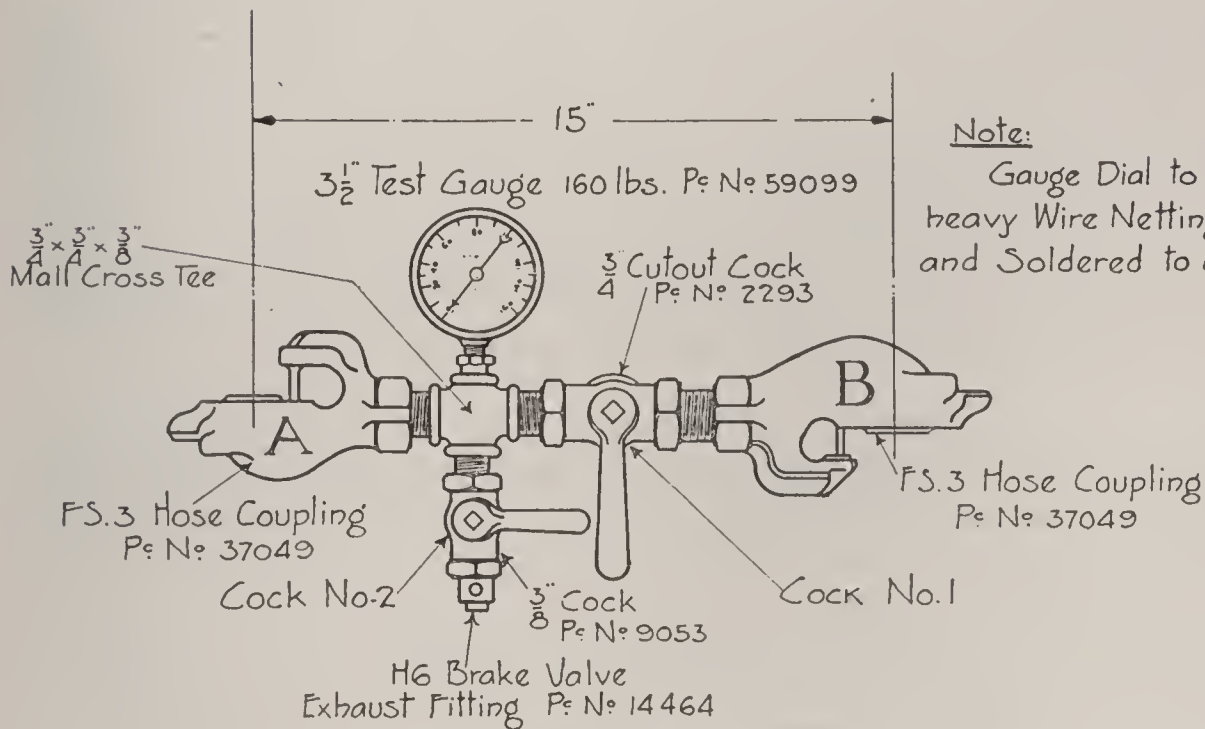
Prior to departure of trains that have been made up or whose consist has been changed, a test of the brakes will be made following the preparation of the train. The preparation consists of seeing that all hose is coupled and hose cocks are open excepting on the front and rear end; that retaining valve handles are turned down; that all hand brakes are released (excepting the number required at the rear end of freight trains to hold the slack while the train is being stretched preparatory to inspection); that conductor's valves, drain cocks and release valves are closed; that all brakes are cut in unless plainly defective or tagged for defects; and while going over train to see that these conditions exist, an inspection should be made for all visible defects. When engine couples on and has stretched the train, the locomotive air hose will first be blown out by opening the angle cock part way (this is very important). Then couple the hose, open the angle cock on the tender and then angle cock on the car, both slowly, after which the train will be inspected for leakage while the locomotive is pumping up the train. When the rear of the train is reached, release any hand brakes found set and request the conductor or brakeman to signal the engineman to apply the brakes. Next inspect the train and ascertain whether all brakes have applied and have correct piston travel. As soon as the inspection is completed signal the engineman to release the brakes and returning to the caboose note whether all brakes have released, hand 975 report to the conductor and advise verbally how many brakes are cut out or inoperative. Serious defects in the brake pipe must be remedied before the train is allowed to start. Defective brakes that cannot be repaired must be cut out and brake defect card applied. In assembling yards, however, the application of a "brake defect card" should be the last resort.

At terminals where testing plants have been installed the outgoing brake test will be made by the aid of the device shown in cut at the end of this sub-para. First of all open cock in yard line air hydrant and blow out all dirt and moisture from the device. Close the angle cock on the car and stop cock Nos. 1 and 2 in test coupling device, attach coupling B to yard line air hydrant, then attach coupling A to air brake hose coupling on car.

To charge the train open cock No. 1, inspect for leakage at test device coupling gaskets, and if any leakage is found correct it. Open angle cock on car (slowly) then while train is charging to standard pressure (70

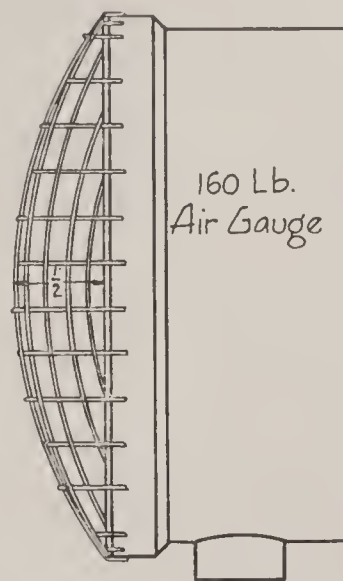
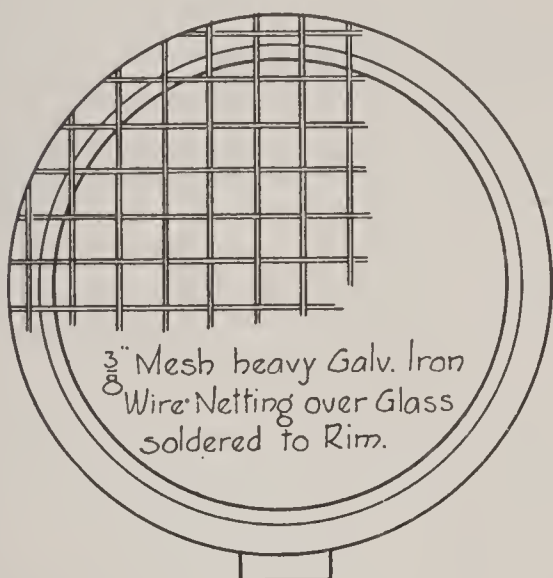
pounds) make the inspection as previously described for leaky unions, couplings, gaskets, angle cocks, air hose etc., and correct all defects found. To test the brake pipe leakage when the train is charged to standard pressure,

Device for Testing Air Brakes on Freight Trains



Note:

Gauge Dial to be protected by heavy Wire Netting over Glass and Soldered to Gauge Cover.



C. M. & ST. P. RY.
Mechanical Dept.
Milwaukee

Air Brake Test Gauge Device

Circular Letter No. 178.

close cock No. 1 on the test device, then reduce the brake pipe pressure 10 pounds by opening cock No. 2. When brake pipe pressure, as indicated by the gage, has been reduced 10 pounds (from 70 pounds to 60 pounds) close cock No. 2 and note the drop of the hand in the gage for a period

of one minute after closing cock No. 2. The drop of the hand on the gage will indicate the number of pounds leakage per minute which should not exceed 8 pounds and if possible not more than 5 pounds.

After inspecting the train for leaks and if necessary making the described test for brake pipe leakage the brakes will be tested as follows:

For a train charged to standard pressure (70 pounds) close cock No. 1, then reduce brake pipe pressure 20 pounds by opening cock No. 2 slowly, close again and immediately inspect train to see that all brakes have applied and have correct piston travel. Mark defects found in accordance with symbols shown above and complete inspection within 10 minutes. Next release the train brakes by opening cock No. 1 and charging train to standard pressure and then proceed to correct defects found during inspection at the same time noting that all brakes have released properly.

In all cases as trains depart it should be observed that brakes have released. If the brakes of a car are sticking the inspector will endeavor to obtain release by pulling on the release rod, but if this fails the train must be stopped and the situation corrected or brakes cut out.

**Sub-para. (VI) INSPECTION AND REPAIR BY AIR
BRAKE MEN OF BRAKES ON
FREIGHT CARS ON REPAIR
TRACKS**

It is our rule to clean freight car brakes on all repair and shop tracks that are equipped with air pressure for brake testing and at some other points in cases of extreme emergency. In order that brakes may be cleaned it is necessary that an inspection be made at such points by competent air brake men of the brakes on all freight cars that arrive on the repair tracks.

Brake cleaners will be provided with a supply of standard brake cylinder lubricant, soap, waste, clean rags, kerosene, quick-drying black paint, white paint for stencilling, a small quantity of graphite grease, and a set of air connections, tools and equipment as specified in section xxxvi of this sub-para. When engaged in their work, they will have, in addition to the tools, a small pail of soapsuds, a standard dummy coupling, and such light supplies as are frequently required during brake cleaning and repairing.

All points where regularly assigned air man or men are employed should make a practice of connecting up the air hose on cars received on repair tracks to yard hydrant by means of testing hose and device before same are jacked up or brake rigging disconnected. On cars that have been set on repair tracks for other than air brake defects, a preliminary test should be made consisting of charging up to standard pressure disclosing leaky or broken brake pipe, porous hose, or leaky angle cocks, cut out cocks and release valves. When charged up to standard pressure (70 lbs.) a reduction of 20 pounds should be made to determine if the cylinder gasket on type "C" cylinders between reservoir and brake cylinder is tight and on the detached type of equipment if the brake cylinder pressure head gasket and pipe connecting the auxiliary reservoir and brake cylinder is tight, next

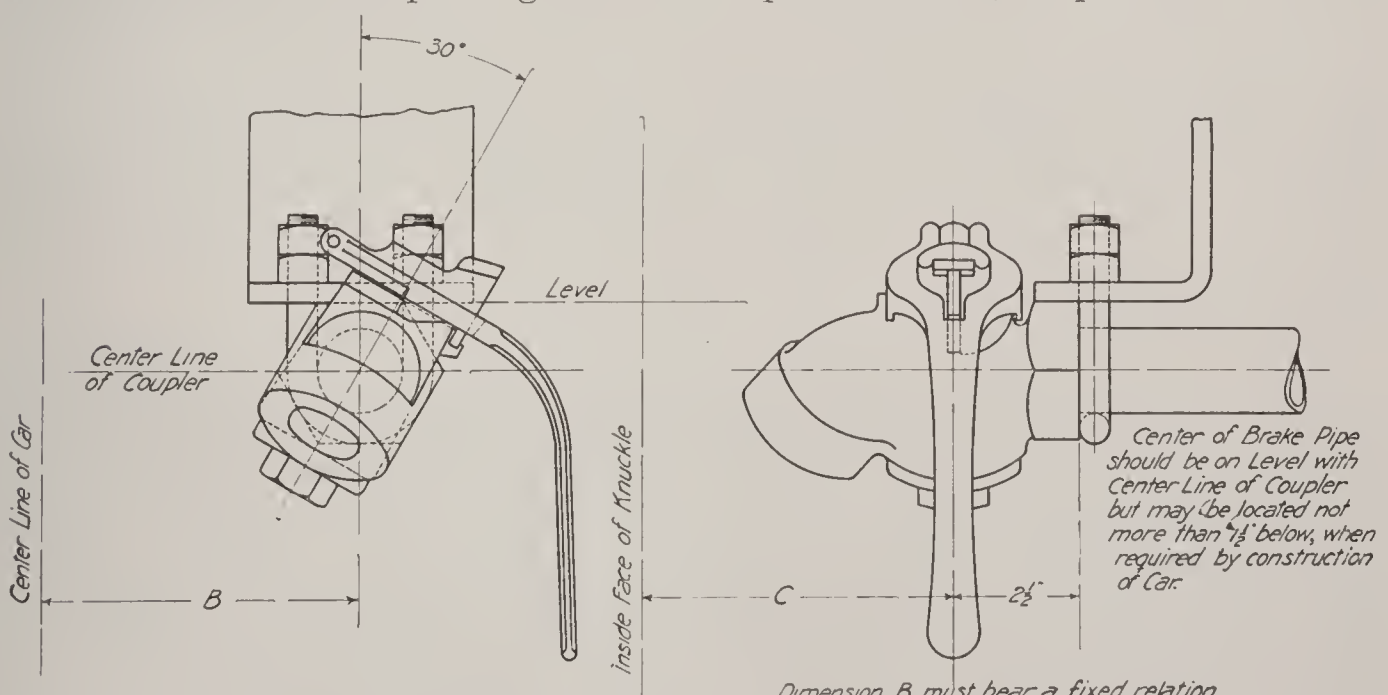
if brake cylinder packing is leaking, then by noting piston travel and angularity of levers if brake rods and connections are of correct type and size.

Cars set on repair tracks marked out for bad order triple valves or brakes failing to apply should be tested very carefully using testing device or portable test truck as per instruction for same, in addition to above described preliminary test, on account of some inspectors in the train yards failing to observe the retarded release feature of the "K" type of triple valve and being misled by the retarded release of a car close to the locomotive or motor and also due to not being able to get to rear cars or to an incoming train for a longer period of time than a reasonable good brake will stay set, will often times lead them to believe and to mark out a car for stuck brakes whereas it was in good order and brake merely released slowly as intended, or a fairly good brake taken for one which would not apply or had leaked off.

By following this method of making a preliminary test many cars are discovered that have nothing wrong with their brakes and can be released without further delay; on the other hand it will let the air brake man know what is to be done in ample time and prevent cars being held over as often times is the case where cars are only tested after general repairs are made and cars jacked down, and therefore this procedure is to be adopted as standard.

When tests disclose either triple valve in bad order or brake cylinder packing leaking it should be treated as an out of date car (9 months) and have annual repairs made as described later herein.

In all cases, whether the brakes are in date or out of date, repairs must be made to any loose or missing pipe clamps, angle cocks or hose out of standard position, loose brake cylinders auxiliary reservoirs and their supporting brackets, brake rods worn by contact with wheels or axles and in addition on system cars, angle cocks which are non-standard in relation to center line of car and pulling face of coupler knuckle, as per cut.



Dimension B must bear a fixed relation to dimension C where dimension B must be increased or decreased from dimensions shown in table. Dimension C shall be determined from the formula $C = 39 - 2B$

	B	C
Wooden Underframe Cars	13	13
Steel Underframe Cars Built after 1916	15	9
For new cars or cars having "D" Couplers	15½	8

The final test after car has been jacked down and brake rigging connected up on cars other than those having old air dates or being treated as out of date cars should be as follows: Charge the brake to a pressure of 70 pounds and make a service reduction of 20 pounds by means of exhaust cock in testing device, yard hose attachment or brake valve of portable test truck. Check for piston travel, which should be 7 inches, next inspect for clearance at the lever guides, see that levers are not fouling, and the angularity of levers is correct. On system cars make sure that the length of rods and location of same, also lever dimensions are standard to car in accordance with FOUNDATION BRAKE RIGGING DIAGRAMS and that the lever sizes are stencilled on underframe of car. If the piston travel is less than 6 inches or more than 8 inches re-adjust to 7 inches and then test for leakage and clearance.

If the brake does not require to be cleaned test the retaining valve and its pipe as described in sections xxvi and xxvii of this paragraph.

The detailed procedure for cleaning, testing, adjusting and repairing brakes on freight cars will be as follows, and is to be carried out in the order given:

(i) *Brake Pipe Leakage Test, Etc.* Having brought hose to the yard connection and tool kit to side of car, close the branch pipe cut-out cock, and having seen that the opposite angle cock is shut, couple the yard hose (preferably to retaining valve end of car), open the adjacent angle cock and charge the brake to 70 pounds. Next, test for and repair leakage from brake pipe and fittings up to the branch pipe cut-out cock. This includes hose coupling gaskets, leakage under hose clamps, through hose (porosity), around the angle cock keys under handle, also threaded and gasket joints, including the main brake pipe union. Open and close angle cock and thereby blow out brake pipe at the free hose. Listen at the coupling to detect angle cock leaking into the hose. Replace if defective. Then connect dummy coupling to hose, open angle cock and complete leakage test here. When inspecting for leakage use soapsuds where temperature will permit (see Section xxxv of this sub-paragraph). If connecting with the yard hose or the dummy coupling discloses bent hose couplings on the car, or if hose couplings have broken stop pins or are otherwise not fit for service, replace the hose.

(ii) *Dirt Collector, Brake Pipe, Etc.* Obliterate the old stencil with the black paint, remove dirt collector cap, and loosen with scraper any solid matter in the dirt collector. Blow out branch pipe and dirt collector by opening and closing the cut-out cock. Coat threads of dirt collector cap with graphite grease and replace. Disconnect branch pipe at triple valve and blow out as before. Pull the branch pipe union connection no further from the triple valve than is actually necessary, otherwise leakage will be developed in pipe joints. Note, at open end of branch pipe, whether cut-out cock is leaking. If so, replace. Remove the short section of retaining valve pipe from the triple valve.

(iii) *Brake Pipe Strainer.* Where there is no dirt collector the pres-

ence of much coarse dirt or scale in the triple valve strainer shows that the screen in the brake pipe strainer is in bad order or missing.

(iv) *Removal of Triple Valve and Gasket.* Bleed all air from the auxiliary reservoir, remove the triple valve, being careful not to tear its gasket; then, after removing the triple valve strainer, turn the triple valve so that its branch pipe opening is downward and rap the side of the check valve case to discharge all dirt, after which apply to it the removed triple valve gasket and attach the opening protectors removed from the clean triple valve (draw bolts true and firm), thus preparing the dirty valve for shipment.

(v) *Disposition of Dirty Triple Valve.* Deliver or forward all removed triple valves and their gaskets to the specified triple valve repair room, from which a like number in good order will be obtained.

(vi) *Clean Triple Valve.* Triple valves received for application to cars will be accompanied by good order gaskets, in place, and have the several openings suitably closed with opening protectors, the latter to exclude dirt and protect threads and gasket surfaces.

(vii) *Triple Valve Gaskets. (Foreign Cars.)* If a triple valve gasket is found in bad order on a foreign car, replace with a new one, and report for suitable charge. Apply both the removed gasket and the one received with the clean triple valve to the dirty triple valve if the triple valve is being shipped to the repair room.

(viii) *Brake Cylinder Cleaning, Etc.* Disconnect and remove the push rod. Apply piston holder. Remove the non-pressure head and piston from the cylinder. Thoroughly clean the brake cylinder, including the flange and joint to which the non-pressure head is bolted, first using the spatula and dull rounded scraper for removal of the heavy gum and grease, and wipe dry with rags or waste. If, as may occur occasionally, the old lubricant in the cylinder is so gummy that it cannot be wiped out, kerosene may be used to soften it, but must not be used where the cylinder can be cleaned without it. Clean the leakage groove. Examine the tube in the auxiliary reservoir and clean it if required.

(ix) *Piston and Packing Cleaning, Etc.* Make certain that the rivets securing the piston to the rod are tight. Remove packing expander. Turn flange of cylinder packing outward just sufficient to clean with dull, round-cornered scraper, and dry-wipe the packing clean inside and out. *Kerosene, gasoline and other light mineral oils must not be applied to packing leather, because they would remove the filler with which the leather packing is made air-tight, harden and crack the leather, and thus destroy its usefulness.* Carefully inspect cylinder packing and if found cracked, cut, or worn thin at any point, or otherwise defective as would cause leakage, replace it with a good one. Note the depression on the packing caused by the expander, as this will indicate uneven bearing and expander partly out of place. Examine the follower for cracks, then measure its diameter, and if it is $\frac{3}{4}$ inches or more smaller than the rated diameter of the brake cylinder, replace it with one of standard size. If the packing appears good, tighten

the follower plate nuts. These nuts sometimes loosen in service and this causes leakage. Clean the joint and flange portion of the non-pressure head which bolts to the brake cylinder. Where very cold weather renders it desirable and a convenient place is available, clean the brake cylinder piston and make any other needed repairs to it in a warmed room.

(x) *New Cylinder Packing Application.* Before applying a new cylinder packing to the piston make certain that the studs are tight in the piston. If any stud is loose remove it, take off the nut, coat the threads of the piston end with white paint, and then, using the stud nut, screw the stud solid in the piston. Place the new packing on the piston so that the flesh (rough) side will come in contact with the cylinder wall. Apply the follower and the follower nuts, but leave the latter loose. Carefully adjust the leather centrally on the piston. Tighten all of the nuts lightly; then, after making certain the packing is still true, draw them firmly and evenly by tightening each a little at a time. The latter is to avoid cracking the follower and causing leakage.

(xi) *Packing Expanders.* Exchange packing expanders for others of similar type that have been tested in, and make to conform with, a special gauge provided at points having triple valve test racks. Send all removed expanders to the same point as the triple valves. Attach to each expander removed from a foreign car a slip or tag showing the car number and initials from which it was removed.

(xii) *Cylinder Lubrication.* Using the grease brush provided, apply a very thin, uniform coating of standard brake cylinder lubricant to the entire inner surface of the barrel of the brake cylinder.

(xiii) *To Replace Brake Cylinder Piston.* Apply the expander; then, seated or kneeling in the most convenient position, a little to one side (usually to the left) of the open end of cylinder, with one leg extended, non-pressure cylinder head resting on knee, and with cap in the expander away from cylinder, and piston facing upward, force expander into its recess in follower by pressing against the packing leather on opposite sides. Holding the expander in place, lift the piston and, still keeping its rod as nearly vertical as the release spring striking the bottom edge of cylinder will permit, enter the piston edgewise into the cylinder until the latter will hold the expander in place. Now, exerting a moderate pressure on the release spring close to the piston (alternating hands as later indicated) press the side of the first finger (fingers closed and thumb extended) against the packing close to one side of the cylinder and, at the same time, use the thumb of that hand, aided by the pressure of the other hand on the release spring, to force that side of the piston slightly inward. The side pressure on the packing must be enough to prevent it being cut or damaged by the edge of the cylinder end as the piston moves inward. Alternate this operation, reversing hands, until the piston is entered sufficiently to prevent its packing being damaged by the edge of the cylinder end. Next, moving the free hand to the end of the piston rod, and slipping a coil of the release spring over the bottom edge of the cylinder as necessary, gradually force the piston into the cylinder until its top is two or three inches inside. This

will require that the rod end be gradually raised, but do not raise it more than necessary. During this time and later do not allow the upper half of the packing to be turned back at all. The dull-edged, round-cornered scraper may be used to aid in this, but do not, under any circumstances, use any instrument that could cut or scratch the packing. Next, raise the piston rod to its normal, horizontal position without allowing the top of the piston to travel inward, thereby insuring against the packing being doubled back, observing the following: As the end of the rod is gradually raised, work it slightly from side to side and pull the bottom of the piston outward fast enough to prevent the top from moving inward. When the end of the rod is horizontal push the piston about half-way in, then rotate the end of the rod around the center line of the cylinder at a distance of about 3 inches. If it binds, this shows that the expander is partially out of place. If so remove the piston and replace more carefully. If the piston binds at any time while being applied do not force it, as to do so may damage its packing. The foregoing instructions may have to be varied from slightly where there is little room near the open end of the cylinder, but should be followed as closely as conditions will permit. Turn the piston, if necessary, to bring the thinnest side of the packing at top of the cylinder, push the piston to the far end of the cylinder, and, after coating the bolt threads with graphite grease, rebolt the head. Draw the nuts uniformly so as to insure a full, true and firm bearing of the head against the cylinder. Reapply and connect the push rod.

(xiv) *Triple Valve Application.* Clean the gasket bearing surface on the auxiliary reservoir, place the gasket on the clean triple valve and then the valve on the reservoir. Holding the valve true against its joint, run all nuts down to a very light contact with the triple valve flange, then tighten firmly, drawing each a little at a time so as to insure a true bearing. Clean and apply the triple valve strainer. Make the branch pipe union joint face substantially true with its connection to the triple valve, apply a gasket and tighten the union.

(xv) *Inspection While Brake Is Charging.* Open the branch pipe cut-out cock and, while the brake is charging, make certain that the release valve is tight in the auxiliary reservoir, and that its vent valve does not leak either from a defective seat or release rod binding. Note whether there is leakage at the triple valve exhaust, and if so apply and release the brake. If this does not stop it, locate the cause and correct before proceeding. Open the release valve with each of its rods. If it fails to vent or will not close without assistance, locate and remedy the cause. Inspect and clean the retaining valve as directed in section (xxiv).

(xvi) *Pipe Clamps.* Clamps must hold their pipes firmly, prevent vibration, and not allow the brake pipe to shift lengthwise if air hose are pulled apart, as in a break-in-two. Any missing jamb or lock nuts must be replaced.

(xvii) *Piston Travel Adjustment.* When the brake is charged to 70 pounds apply by making a service reduction of 20 pounds with the exhaust cock in the yard hose attachment. Measure the piston travel, and if less than 6 inches or over 8 inches release and readjust to about 7 inches.

(xviii) *Foundation Brake Rigging.* With the brake applied as directed in previous section, inspect the foundation brake rigging to see that levers have ample clearance in their guides and elsewhere to prevent striking or binding with 12 inch piston travel, that all cotters are in place, and points well spread, that hangers and dead lever fulcrums are secure, that the brake levers are standard, that rods are not being cut by axles, and that the rigging in general is in good order. Before making any changes to provide lever clearance insure, if possible, that the length of rods and guides and location of latter are standard for the car. If it is found necessary to readjust the brakes, the first thing to be done is to close the cut-out cock in the cross-over pipe and bleed the auxiliary reservoir, so as to prevent possibility of injury.

(xix) *Loose Brake Cylinders and Reservoirs on Their Supports.* If the brake cylinder moves during application or release, or if any of the cylinder or reservoir bolts are loose or gone or lock nuts missing, needed repairs must be made by the brake cleaners unless this work has been assigned to other workmen, in which case brake cleaners will not report the brake in good order until any necessary repairs have been completed. One man can observe for movement of the brake cylinder and reservoir and their supporting brackets by bleeding off the brake. Movement of these parts causes pipe leakage and breakage. When brake cylinders and reservoirs are to be tightened on their supports run up two or three of the nuts only sufficient to bring the bolting flanges into light contact with the supports. Then, if the bolting flange is not in contact with the supporting brackets at each bolt hole, line up with cut washers where required. A failure to do this will result in springing and cracking auxiliary reservoirs and springing brake cylinders out of round.

(xx) *Brake Cylinder Leakage Test.* Brake cylinders that have just been cleaned will be tested with a gauge applied to the triple valve exhaust port. Insure that the plug in the unused exhaust port is tight and close the test gauge cock. The brake being charged to 70 pounds, apply with a service reduction of 20 pounds, and release the triple valve so the gauge will show the cylinder pressure, which should be 50 pounds. If the gauge now shows less than 50 pounds, reapply lightly and release until 50 pounds or more is had. Try to avoid getting over 60 pounds. If over 50 pounds, reduce to this amount with the test gauge cock, then note the loss, if any, during the next minute. Any loss is the amount of brake cylinder leakage. If it exceeds 5 pounds per minute with a brake that has just been cleaned the cause must be found and leakage reduced to not over 5 pounds. The most common sources of brake cylinder leakage are the cylinder packing, the brake cylinder pressure head gasket, the bottom of the triple valve gasket and, with detached equipment, the pipe connecting the auxiliary reservoir and brake cylinder. While testing for cylinder leakage, if temperature will permit, apply soapsuds around the piston rod next to the cylinder head. If non-pressure head has a vent, as with old patterns, cover with wet hand. If the piston packing is leaking this will now usually be indicated by bubbles around the rod. If the cylinder packing is not leaking and the leakage is indicated by the test gauge, test the other joints men-

tioned. If the pressure rises during the brake cylinder leakage test there is leakage into the brake cylinder past the emergency valve, the check valve case gasket, the triple valve slide valve, the triple valve gasket or an end of the tube in the auxiliary reservoir. If the rise in brake cylinder pressure is 3 pounds or less per minute, repairs may be omitted, but if it exceeds 3 pounds locate the cause and repair before continuing the test for brake cylinder leakage. To determine positively whether the cause is in the auxiliary reservoir or triple valve, first apply another clean triple valve with a new gasket and retest the cylinder. If the trouble still exists, the leakage is probably in the auxiliary reservoir and may be positively located without removal by substituting for the triple valve a flat plate having a pipe tapped opening at the center for connection of the yard air plant to the reservoir and having a section of the plate removed to uncover the end of the auxiliary reservoir tube, after which, the leak may be located by inspection or application of soapsuds and can usually be remedied by swelling the tube with a roller or drift. Leakage into the brake cylinder may be present without the gauge pointer rising, as where there is an equal or greater leakage out of the brake cylinder. Use of soapsuds as mentioned will aid in detecting such a condition.

(xxi) *Cylinder Gasket Replacement.* A defective cylinder head gasket in the combined equipment (cylinder bolted to reservoir) can be replaced without removing the parts from the car if the cylinder head bolts are accessible, as follows: Clamp the piston rod close to the cylinder head, as in cleaning a brake cylinder; loosen or disconnect, as necessary, the branch pipe connection to triple valve; support the auxiliary reservoir, and slack off or remove the cylinder head bolts, and then carefully pry the reservoir back enough to clean the joint and insert the new gasket. The auxiliary reservoir may have to be entirely detached at all points. As the gasket can be applied more accurately from the inside of the cylinder when the auxiliary reservoir is not removed, always combine this work with that of cylinder cleaning where practicable.

(xxii) *Cylinder Packing Leaking After Cleaning.* If the cylinder packing is leaking, cut out the brake, bleed all air from the auxiliary reservoir and repair as instructed in Sections viii, xiii, and xiv.

(xxiii) *Disposition of Old Packing and Gaskets.* All brake cylinder packings, cylinder cap gaskets and check valve case gaskets removed because defective, will be cared for in manner to prevent further damage to them and, except as directed in Sections iv, v, and vii, turned into the storeroom not later than the first day of each month for disposition as directed by special instructions.

(xxiv) *Retaining Valve Cleaning and Inspection.* When a brake is cleaned, remove the retaining valve cap, then the valve; clean the vent port, but do not increase its original size; moisten the valve seat, rub the valve on its seat and then wipe clean. Finally wipe and blow the case and, after lubricating the cap threads with graphite grease, replace the cap. With the weighted type of retaining valve, if wear allows the weight to rest on the bottom of the case, replace the entire retaining valve. The retaining

valve must have a good-order handle, be in a vertical position and firmly attached to the car.

(xxv) *Retaining Valve Pipe Inspection and Installation.* While the retaining valve pipe is disconnected try it for loose joints by a moderate twist at the free end, and make any needed repairs. After reconnecting see that it is clamped at a distance of six feet from both the triple valve and retaining valve, and at not to exceed six feet intervals between these two points. It must not vibrate when car is running. Before entering the end of the retaining valve pipe which screws into the triple valve, make certain that the thread is good and not so long that the end of the pipe comes in contact with the brass bushing in the triple valve body. After applying this short section, make certain that the two halves of the adjacent union are tight on their pipes, and that the union joint faces are true with each other. If the union is of the flat-joint type apply a good order standard gasket.

(xxvi) *Retaining Valve Pipe Test.* To test the retaining valve pipe on cars, turn up the retaining valve handle. With brake charged to 70 pounds, make a service application of 20 pounds. Open the by-pass in the test hose attachment and, as soon as the triple valve moves to release position (indicated by blow commencing at retaining valve), start at the triple valve and quickly apply soapsuds to all of the joints of the retaining valve pipe to determine if they are tight. Repair any defects found and retest, repeating this operation until the pipe is tight.

(xxvii) *Retaining Valve Test.* After it has been determined that the retaining valve vent port is open (for this purpose do not use an instrument which will enlarge it)—the brake being operated as directed in Section xxvi—the retaining valve must hold enough pressure to prevent moving the brake shoes on the wheels with the foot or other convenient means for a period of 3 minutes after the triple valve moves to release position on brakes which have just been cleaned, and within 1½ minutes on brakes which have been tested only (not cleaned). It is permissible to jar the vertical section of the retaining valve pipe to aid the retaining valve in seating accurately. If the valve does not close and the brake releases, proceed as directed in Section xxiv.

(xxviii) *Retaining Valve Pipe Renewals.* If a retaining valve pipe runs from the end of car as directly as possible to the triple valve connection, any looseness of the cylinder or springing of its supporting bracket will break the pipe or the boss at the triple valve exhaust port, or destroy the latter's threads. To avoid this, the triple valve end of the pipe must be flexible. Where repairs must be made for other reasons re-pipe as follows: With cars having the triple valve between trucks, run the long section horizontally until almost in line (across car) with, but higher than, the triple valve exhaust port. Then bend down to connect vertically with a union on the short connection to the triple valve, which may be either a bent nipple or two straight nipples connected with an elbow. Properly made the bent nipple, when laid in the angle of a square, will not touch the edge of the square for about 3 inches each way from the corner, thus

providing a gradual bend. Each end of the short connection will be 7 inches from the corner of the square. With cars having triple valves located above the sills, as on hopper cars, the retaining valve pipe must provide for a moderate amount of both vertical and horizontal movement of these devices.

(xxix) *Angle Cock Test.* When yard hose is disconnected and with brake pipe yet charged, quickly note whether the adjacent angle cock is leaking into the hose and replace if defective. Test as instructed in Section (i) for the other one. If coupling guard pins are missing or badly worn, hose must be replaced and sent to shops for repairs.

(xxx) *Angle Cock and Hose Coupling Positions.* The angle cock must stand 30 degrees from vertical, which will point the hose toward the center of the track. Turn air hose in the angle cock to such a position that when the couplings of two adjacent cars are raised to connect neither hose will have to be twisted. If coupled hose twist to one side when charged the couplings did not face properly before connecting. This damages gaskets and shortens life of hose.

(xxxi) *Angle Cock Location.* The standard position of angle cock is designated by the A. R. A. When repairing foreign cars endeavor to maintain the owner's standard position for that car. On system cars maintain the A. R. A. standards, conforming to drawings.

(xxxii) *Stencilling and Stencil Records.* Stencil for cleaning, repairing and testing in accordance with A. R. A. Rules. Keep a record under dates when work was done, of initials and numbers of all cars upon which the brakes are cleaned and tested, the old stencil and the new stencil, and on foreign cars of the materials used for repairs. Include all this in monthly or other reports as directed in special instructions.

(xxxiii) *Hand Brake.* Apply the hand brake and inspect it to determine whether it is in safe, operative condition. The chain must not catch on the staff support, and the rods, levers, etc., must be free from any interference that would prevent the delivery of hand brake force to the brake shoes.

(xxxiv) *Brake Cleaning by Two Men.* The instructions given in the preceding paragraphs cover the procedure when the work is to be done by one man. When two men are assigned to clean a brake, the order of doing the work must be followed as closely as practicable. One man at a time only should tighten nuts securing cylinder heads, piston followers, and triple valves, as two cannot draw the nuts uniformly, as directed. If economy of time necessitates the application of the triple valve before the piston is placed in the brake cylinder, before applying the triple place the mouth against the branch pipe connection to the check case and blow the piston and slide valve to their release positions, thereby insuring the necessary vent from the brake cylinder.

(xxxv) *Preparation of Soapsuds.* The plain soapsuds is not, as a rule, as good for locating leaks as a lather, and the supply is used up faster. To make a lather, twirl the brush back and forth rapidly in the

soapy water by rolling the brush handle between the palms of the extended hands.

(xxxvi) *Tools and Equipment for Freight Brake Cleaners.*

Item

1. 1 Brake Test Apparatus.
2. 1 1½" x 50' Hose with FS-4 Couplings.
3. 1 Cylinder Test Gauge and Fittings.
4. 1 Hollow Piston Rod Clamp.
5. 1 Drift.
6. 1 Short Wrench for 5/8" Rough Nuts.
7. 1 Short Wrench for 5/8" Finished Nuts.
8. 1 Double End Wrench for 1½" Rough and Finished Nuts.
9. 1 Double End Wrench for 5/8" Rough and Finished Nuts.
10. 1 Scraper and Cotter Pin Opener.
11. 1 1½" and 5/8" Stud Nut.
12. 1 Spatula with Elastic Blade about 7" long by 11/8" wide.
13. 1 10" Pipe Wrench (Stillson or Trimo).
14. 1 24" Pipe Wrench (Stillson or Trimo).
15. 1 1½ pound Ball Pein Hammer
16. 1 Flat Cold Chisel.
17. 1 Round Nose Chisel.
18. 1 Stencil (for cleaning dates, etc.).
19. 1 Cylinder Grease Brush (with short handle).
20. 1 Soap Suds Brush (about 2" round).
21. 1 Stencil Brush (about 1" round).
22. 1 Black Paint Brush (flat about 2" wide).
23. 1 Graphite Grease Brush (1/4" or 3/8" round).
24. 1 Set Cans or other receptacles with Cylinder Grease, Soapsuds, white stencil paint, quick-drying black paint and graphite grease.
25. 1 Supply of Waste, Rags or both.
26. 1 Supply of the frequently needed light brake repair parts.
27. 1 Supply of Clean Triple Valves.
28. 1 Supply of Packing Expanders and Cylinder Packings.

**Sub-para. (VII) OUTGOING INSPECTION OF BRAKES
ON PASSENGER CARS IN TRAINS
WHEN MADE BY OTHER THAN
AIR BRAKE MEN**

A test of air brakes must be made on all outgoing passenger trains departing from originating terminals. As soon as the engine is backed on to the train an inspection should be made to ascertain whether there are any leaks and where discovered they must be attended to at once. This lookout for air leaks can be made at the same time as the general inspection of the equipment is made. When completed signal the engineer to apply the brakes by opening the discharge valve, to which is connected the signal cord, four times—each of about two seconds duration. When application is made inspection will be begun to establish that all brakes have applied and that piston travel is correct. Before adjusting the brake of a car for too

short piston travel, it must be learned from the engineer that a reduction of 25 pounds has been made. The signal to release brakes (same as for application) after the test, must be given with the air whistle signal from the rear car. When release has been signalled, see that the brakes on each car have released, and as train departs take up a position where it can be observed that no brakes are sticking. If during inspection, a brake sets in quick action it must be located, cut out and carded.

In connection with the testing of passenger train brakes it must be clearly understood the practice of observing the brakes apply and release on the rear car only cannot be accepted as an air test, and each individual car must be inspected. Release of brakes will not be signalled for until after completion of inspection. It should be borne in mind that, *after the train is handed over* (in other words reported O. K.), the train crew has to make another and separate test of the brakes, the procedure for which does not concern us. Inspectors will themselves signal for both the application and release of brakes for their own test.

The most common air brake in use on our later passenger equipment is what is known as the LN equipment, consisting of a type L triple valve and the N type of brake cylinder. This equipment can be distinguished by observing that it has two reservoirs—one an auxiliary reservoir and the other a supplementary. These reservoirs are invariably placed alongside of one another. If, however, any doubt exists as to whether the equipment is LN, it can be definitely established by noting that the branch pipe on the LN equipment is connected to the cylinder pressure head (the L triple being known as a pipeless triple), whereas other types are piped into the valves.

Inspectors will observe, however, that in addition to LN brake equipment, we have in use PM (P triple and M type cylinder) and NYS (New York High Speed, which corresponds to the PM). On foreign cars PC (Pressure Control) and UC (Universal Control) will sometimes be found. When a train is made up of which 75% or more of the brakes are LN, the equipment will function in the ordinary way, with supplementary reservoirs cut in. When the brakes other than LN (PM, NYS, PC and UC) represent more than 25%, and consequently LN forms *less than 75%* of the brakes of the entire train, the *supplementary reservoirs on the LN equipment will be cut out*.

The reason for this is that LN equipment is provided with certain graduated release features, while the other type of brake is not, and this results in the breaking at certain stages being done only by the cars with LN equipment.

When these cars form more than three-quarters (75%) of the train, no damage is done, but when it gets below that point the braking is confined to too few cars. When the LN supplementary reservoirs are cut out all brakes in the train function on the same basis.

The PC and UC equipment can, by changing the position of a cap in the valve, be made to function with graduated release features, but

normally inspectors, other than air brakemen, will be unable to know when a brake is so set up, and will therefore include all PC and UC equipment in the brakes "other than LN equipment."

At all divisional inspection points between departing terminal and final destination, an inspection will be made of brakes by one (preferably two) of the inspectors standing in such a position that they may observe whether any brakes are sticking as train departs from the depot. When going over train in the course of general inspection, it will be observed that each brake has applied, and that the piston travel is correct. At such points piston travel will not be interfered with unless the travel is less than 6 inches or more than 10, when it will be corrected. When cutting a car out, close the cut-out cock in the branch pipe to triple valve, open the drain cocks of both auxiliary and supplementary reservoirs, *and leave them open*. Card cut-out cock. The air brake defect card should be applied only as a last resort by inspectors; if however, the defects cannot be repaired, the card should be attached to the branch pipe near the triple valve and the particular defect for which the brake is cut out must be marked on the card.

When changing engines at terminal points always release all pressure from signal system on train, in order that it may be known that the engine coupling on to the train will fully charge and maintain the pressure. Before coupling the signal hose on engine to the train, open the cock in signal pipe on tender and blow out all foreign matter. At a terminal if the required pressure cannot be obtained in the signal system inspect for leakage of hose couplings, also at car discharge valves. If a car discharge valve leaks and cannot be repaired quickly, close the cut-out cock in the branch pipe to the car discharge valve and notify the conductor.

**Sub-para. (VIII) INSPECTION, TEST AND REPAIR
BY AIR BRAKE MEN OF BRAKES ON
PASSENGER CARS IN COACH YARDS,
SHOPS OR ON REPAIR
TRACKS**

When passenger train cars reach coach yards, shops, or repair tracks the brakes are to be inspected, tested and repaired when necessary by competent air brake men. Where coach yards are equipped with portable test trucks such trucks will be used for making the tests. At points not equipped with portable test trucks, installed testing device will be used for this purpose.

(i) CAUTION: Before undertaking any work on cars where an application of the brakes might result in personal injury, employes will first cut out and render brakes inoperative in the following manner:

Close cut-out cock in branch pipe to triple valve and open drain cocks in auxiliary and supplementary reservoirs leaving them open. Employes performing these duties will be held responsible for closing drain cocks and cutting in brakes after this work has been performed.

Before commencing test be sure that:

(a) All hose are connected up and angle cocks and cut-out cocks are

open, including signal line and that the handles on cut-out cocks on signal line have handles pointing downward when open.

(b) Supplementary reservoirs and water raising systems are cut in.

(c) Angle cocks are in the proper location and at the proper angle (A. R. A Standard).

(d) Hose or brake pipe are not visually defective.

First blow all moisture out of yard line air hydrant and then connect to portable test truck or testing device, and brake pipe and signal pipe of cars and allow same to charge.

Repairs will first be made to any loose or missing pipe clamps, angle cocks or hose out of standard position, brake rods worn by contact with wheels or axles, also see that retaining valve handles are down and hand brakes released (except where hand brakes have been set to hold train), that all pins have cotter pins applied, and all reservoirs have standard drain cocks, (handles turned down to close), and that the brake equipments are not out of date for periodical cleaning, (brake cylinders 6 months and triple valves 3 months.) At least 5 inches should remain on slack adjuster for take up, otherwise the foundation brake rigging should be re-adjusted. Following these repairs, where necessary the brakes will be tested, adjusted, and repaired in accordance with the following and carried out in the order given.

Undesired Quick Action Test. When train is fully charged, make an initial brake pipe reduction of 7 pounds and after 10 seconds follow with a light reduction of 3 pounds.

Note the brake pipe hand on the gauge during the time the light reduction of three pounds is being made, and if it suddenly fluctuates it indicates a triple valve has produced quick action. In such case release the brakes and recharge. After train is charged to standard pressure (90 pounds), make a reduction of 5 pounds, immediately inspect for brakes which did not apply. If there is a car on which the brake does not apply, that triple valve should be removed.

Brake Pipe Leakage Test. If during the undesired quick action test, quick action is not indicated by the gauge and after the 7 and 3 pound reductions have been completed note the drop of brake pipe hand on air gauge for one minute, which will indicate brake pipe leakage, which should not exceed three pounds. If in excess of this amount, leakage should be located and remedied.

When during the test quick action has occurred and after triple valve has been located and changed brake pipe leakage test should be made from a 10 pound reduction as in above manner.

Piston Travel Release Test, Etc. After the brake pipe leakage test has been made, the reduction should then be continued until a total reduction of 25 pounds from standard pressure has been made. Then inspect all brake cylinders for piston travel which should be adjusted to $7\frac{1}{2}$ inches

on cars having automatic slack adjusters, and 7 inches on cars not so equipped. Piston travel should always be adjusted after brake shoes are changed. When inspecting for piston travel, it should be noted that all shoes are against the wheels and levers are not fouling.

Release test will be made by allowing brake pipe pressure to charge up through by-pass and proper sized orifice of variable choke disc valve for given number of cars where improved testing device is used, or the choke fitting where portable test truck is in operation. Any triple valve that fails to release must be removed.

On trains having L. N. equipment an additional test should be made as follows:

With train charged to standard pressure, make a 25 pounds reduction. After this reduction has been completed, make a partial release of the brakes by allowing the brake pipe to charge up about 12 pounds. Wait 10 seconds and make another partial release with a charge up of 5 pounds. Wait 10 seconds, then make a complete release. If any triple valve fails to release on this test it should be removed.

Signal Line Test. When preparing to make tests connect the brake and signal hose on the car to the portable test truck by means of yard hose and triple hose fitting and open the angle cock and signal pipe stop cock which will permit the signal pipe to be charged simultaneously and equally with the brake pipe.

Signal line and car discharge valves should be tested for leakage, and inspector should pull signal cord in each car to insure that car discharge valves open and close properly and have not been cut out for any purpose. If found cut out, the cause for same should be located and remedied. It should be noted that cords to discharge valves and conductors valves, respectively, are free from knots, properly run over pulleys, and of sufficient length to avoid trouble from shrinkage in damp weather.

Express, milk, refrigerator, or cars of similar type which seldom reach coach yards or repair tracks are invariably to be tested singly.

(ii) *Dirt Collector, Brake Pipe Branch, Etc.* The same as for freight cars excepting dirt collectors will be cleaned every three months at time of triple valve removal and on cars have the pipeless type of triple valves the union connecting branch pipe to pressure head should be disconnected and strainer inspected if there is an indication the blow of air is retarded in blowing out the branch pipe.

(iii) *Brake Pipe Strainer.* The same as for freight cars.

(iv) *Removal of Triple Valve and Gasket.* The same as for freight cars.

(v) *Disposition of Dirty Triple Valve.* The same as for freight cars.

(vi) *Clean Triple Valve.* The same as for freight cars.

(vii) *Triple Valve Gaskets (Foreign Cars).* The same as for freight cars.

(viii) *Brake Cylinder Cleaning and Lubrication.* Cylinders must be cleaned every six months, and must never be lubricated without first being cleaned. The cylinder head should be taken off, the piston removed and thoroughly cleaned, being careful not to use KEROSENE, GASOLINE or any other MINERAL OIL in cleaning the packing leather; this should be wiped off dry, using a dull round cornered scraper to remove any hard substance. Expander rings must be checked to see that they are not out of round, and placed in the cylinder without binding. In assembling, the opening should always be placed on top. To lubricate the cylinder, use a small amount of Emery Compound applied evenly around the walls of the cylinder. The following is the correct amount for one cylinder:

10" cylinder requires 2	ounces of lubricant
12" cylinder requires 2½	ounces of lubricant
14" cylinder requires 3½	ounces of lubricant
16" cylinder requires 4	ounces of lubricant
18" cylinder requires 5	ounces of lubricant

The leakage must be known to be clear, also the slack adjuster port in the wall of the cylinder. If the same packing leather is to be replaced, it should be turned top to bottom to even up the wear. After the cylinder is cleaned and assembled it should always be tested for leakage as follows: Connect the test gauge to the exhaust port of type "P" and "S" triples, and the retaining valve connection in the cylinder pressure head on cars with "L. N." equipment, then apply the brakes with a full service application (about 25 pounds) close the test gauge cock and release the brakes, if the gauge shows less than 50 pounds re-apply until 50 pounds is secured. Then note the leakage if any, which will be indicated on the gauge. A greater leakage than five pounds per minute is excessive and the cause must be located and remedied.

(ix) *Piston and Packing Cleaning, Etc.* The same as for freight cars.

(x) *New Cylinder Packing Application.* The same as for freight cars.

(xi) *Packing Expanders.* The same as for freight cars.

(xii) *Cylinder Lubrication.* See (viii).

(xiii) *To Replace Brake Cylinder Piston.* The same as for freight cars.

(xiv) *Triple Valve Application.* Clean the gasket bearing surface on the brake cylinder pressure head, place the gasket on the clean triple valve and then the valve on the brake cylinder pressure head. Holding the valve true against its joint, run all nuts down to a very light contact with the triple valve flange, then tighten firmly, drawing each a little at a time so as to insure a true bearing. Clean and apply the triple valve strainer. Make the branch pipe union joint face substantially true with its connection to the triple valve, apply a gasket and tighten the union.

(xv) *Inspection While Brake Is Charging.* The same as for freight cars.

(xvi) *Pipe Clamps.* The same as for freight cars.

(xvii) *Piston Travel Adjustment.* When the brake is charged to 90 pounds apply by making a service reduction of 25 pounds with the exhaust cock in the yard hose attachment. Measure the piston travel, and if less than 6" or over 8" release and readjust to about 7".

(xviii) *Foundation Brake Rigging.* At coach yards and originating terminals a thorough inspection must be made of brake beams, hangers, pins, cotter keys and all parts of the foundation brake gear and apparatus. All levers must be adjusted to the proper angle, observing that there is no obstruction to prevent the free operation of the levers and rods, and that there is sufficient clearance between the brake arrangement and the truck parts. With the brakes released see that the slack is evenly divided between both ends of car. Be positive that all parts of the brake rigging is connected properly and that all lever pins are of the proper size and have a cotter key in place and properly opened. Air brake men should observe that the brake beam hangers are of equal length, that is, see that there is not one short and one long one on the same beam, as this will cause one shoe to ride the wheel flange and interfere with proper braking. Whenever this condition is found, the foreman in charge should be informed and the necessary steps taken to rectify. Piston travel should be maintained to as close to 7" as possible (standing). Cylinder levers must be known to be of proper dimensions. The dimensions of the lever is always stencilled on the car near the brake cylinder and the levers should be frequently checked to see that the dimensions correspond. The dimensions of the live and dead truck levers on four wheel trucks should also be checked; these dimensions are always 7" x 24½" between center of holes. Whenever making any adjustment of rods or levers under cars, the cut out cock in the crossover pipe must first be closed and auxiliary reservoir bled to protect the person doing the work from injury. Great care is to be exercised to see that brake beam safety hangers are of such length as will not allow the beam or parts to come in contact with the rail in case the brake beam should have to depend on the safety hangers for support.

CONDUCTOR AND SIGNAL VALVES must be examined each time car is tested, to see that they are operative and free from leaks.

(xix) *Brake Cylinder Leakage Test.* The same as for freight cars excepting that the brake pipe pressure will be 90 pounds.

(xx) *Cylinder Packing Leaking After Cleaning.* The same as for freight cars.

(xxi) *Disposition of Old Packing and Gaskets.* The same as for freight cars.

(xxii) *Pressure Retaining Valves.* Retainers must be cleaned at each brake cylinder cleaning and thoroughly tested. Whenever practicable they should be removed and replaced with one which has been cleaned and tested in a triple valve room. Care must be taken in placing the handle in the proper position.

(xxiii) *Retaining Valve Pipe Inspection and Installation.* The same as for freight cars.

(xxiv) *Retaining Valve Pipe Testing.* The same as for freight cars excepting that the brake be charged to 90 pounds and service reduction made of 25 pounds.

(xxv) *Angle Cock Test.* The same as for freight cars.

(xxvi) *Angle Cock and Hose Coupling Position.* The same as for freight cars.

(xxvii) *Angle Cock Location.* The same as for freight cars.

(xxviii) *Stencilling and Stencil Record.* Wherever possible the cleaning date for triple valve and brake cylinder should be applied in standard method showing day, month and year to both sides of car, in one inch figures and letters. Record will be kept of numbers or names of all cars so handled.

(xxix) *Hand Brake.* The same as for freight cars.

(xxx) *Automatic Slack Adjuster.* Automatic slack adjusters should be cleaned and all parts carefully inspected and given the proper attention each time the brake cylinder is cleaned. During the inspection, see that the ratchet nut teeth are not broken, also the release spring and that the brass washer is in place. After removing the cylinder from the casing and piston, thoroughly clean the piston and packing leather and examine the parts for defects. If the packing leather appears to be in a serviceable condition, replace the expander, lubricate the leather and slack adjuster cylinder with the same compound as used for the brake cylinder. On completing the cleaning and lubricating, and before securing the cylinder, draw it away from its seat on the casing, cover the cylinder pipe connection with the palm of the hand and then press the cylinder toward its normal position. This will compress the air in the cylinder. If there is leakage the cylinder will gradually move to contact with its casing, thus indicating the need of locating and repairing the leakage immediately. To lubricate the ratchet nut and screw, place sufficient dry graphite in the adjuster nut to touch the bottom of the screw. The screw must not be oiled.

(xxxi) *Applying New Brake Shoes to Cars Having Automatic Slack Adjuster.* When applying new shoes obtain the necessary slack by turning the slack adjuster nut, one-quarter turn to the right (direction to take up slack) to make certain the pawl is disengaged. Then turn the slack adjuster nut to the left until the slack is sufficient to permit at least $8\frac{1}{4}$ " piston travel after the new shoes are applied. (Do not change the adjustment at any other point in the brake rigging except to correct improper changes previously made.) If the adjuster cross-head is at the outer end of this adjuster body and locked, loosen the stop screw about one-eighth of an inch, turn the adjuster nut one-quarter turn to the right to free the pawl, and then to the left to let out the required slack. Retighten the stop screw, using two wrenches to make it secure.

When brake shoes have been renewed, apply the brake with a full service

application, then measure the piston travel (which should be at least $8\frac{1}{4}$ " , so as to operate the slack adjuster) and inspect the brake and slack adjuster cylinder, also the joints of the adjuster cylinder pipe for leakage. Whenever a new shoe is applied, the shoe on the opposite end of the brake beam must be examined, and if the difference in thickness between the old and new shoe is more than $\frac{1}{4}$ "—that is, is sufficient to be noticed by the eye without measuring—two new shoes are to be applied to overcome the distortion of brake beam that would otherwise result.

Place a chalk mark across the casing and the adjuster nut to show later whether the adjuster has operated during the inspection. Inspect the foundation brake gear to determine whether there is ample clearance between levers and lever guide for additional movement in the direction of the brake application, whether the angularity of all levers is correct, and whether all rods are clear, with ample clearance between rods and axles of six wheel truck brakes. Release the brakes and note whether the adjuster nut has turned, indicated by the chalk mark being broken. Next take up the slack on the adjuster so it will give $7\frac{1}{2}$ " standing travel. The piston in which the adjuster cross-head is left, should be indicated by a chalk mark on the adjuster body as this will later indicate whether the adjuster is operating and the amount of slack it has taken up since the last adjustment. Starting on a run there should be more than sufficient take-up remaining on each slack adjuster to insure its ability to regulate the piston travel to the next terminal, at least 5".

(xxvii) *Centrifugal Dirt Collectors.* Remove the dirt collector cap and loosen with scraper any solid matter on the dirt collector. Thoroughly blow by opening and closing cut-out cock. This must be done every time triple valve is changed. Coat thread of dirt collector cap with graphite and replace.

(xxviii) *Preparation of Soapsuds.* The same as for freight cars.

(xxix) *Tools and Equipment for Passenger Brake Cleaners.* The same as for freight cars.

(xxx) *Air Pressure Water Distributing System.* On many of our passenger cars we have an air pressure water distributing system and as this has some bearing upon the operation of the brakes it is necessary that the pressure governing device be tested at least once in each three months, preferably when the triple valve is exchanged, and at any other time when water is found in the brake system or where the air brake sticks on the car without apparent cause. So that it may be known how to test the governor and reducing valve the following is laid down:

Yard test for governor will be made by charging the system to standard pressure, closing the cut-out cock in air brake crossover pipe, opening the drain cock in each of the air brake reservoirs. After all air pressure is relieved from these reservoirs, close drain cocks and leave them closed five minutes. Hold the hand at the auxiliary reservoir drain cock and open same. If any pressure escapes, it indicates that governor valve is leaking and same should be removed and repaired. If no pressure escapes valve may be considered in serviceable condition. Defective valves should be

sent to Milwaukee or Tacoma shops for repairs. When cars have been tested, the designating letters for the terminal together with the date of testing shall be stencilled on the side of the water boxes in 1" white block letters.

Yard test for reducing valve will be, with water in the water tanks charge the air brake and water distributing system to standard pressure. Then open the water faucet to the wash basin in the lavatory; if the pressure throws the water out of the basin while being drawn, it indicates that the reducing valve is leaking or improperly adjusted and same should be removed, and repaired.

Sub-Para. (IX) **CLEANING AND HANDLING OF TRIPLE VALVES**

The cleaning and handling of triple valves constitutes such an important factor in connection with the maintenance of air brakes, that the instructions governing their cleaning and handling are published in full, as follows:

(i) As the triple valve is considered the heart of the air brake, a thorough understanding of its elementary functions and principles of operation on the part of the test rack operator and triple valve cleaner and repairman is not only important, but absolutely essential in order to obtain the best results possible in its maintenance and bringing it up to its proper standard.

It is very important that the triple valve be maintained at the highest practical efficiency, and in order to determine promptly and accurately whether or not triple valves are up to the proper standard of workmanship, they must not be cleaned on car but removed and replaced with valves of duplicate types which have been properly cleaned, lubricated, repaired and passed the prescribed codes of tests on the Standard A. R. A. triple valve test rack.

(ii) The following table includes size of brake cylinder and Standard Westinghouse Triple Valves with piece number:

Cylinder Size	Locomotive or Tender	Passenger Cars		Freight Cars
		Old Equipment	New Equipment	
8"	F1-4233			K1-27852
10"	F1-4233	P1-1760		K2-28968
12"	F2-1826	P2-1775	L2-15500	
14"	F2-1826	P2-1775	L2-15500	
16"	F2-1826	P2-1775	L3-16370	
18"		P2-1775	L3-16370	

Style E—N. Y. or F1 Triple Valves supercedes G-24.

Style C—N. Y. or F2 Triple Valves supercedes F-25.

Where 1/2" piping is used the 3/4" Triple Valve will be bushed with a flush bushing.

(iii) When types H-1 and H-2 triple valves get to a point where they need to be re-standardized, or any factory repairs, or the type H-1 (F36) with bushings in need of truing up or a combination of repairs to slide valve, its seat and piston ring will be converted to K1 and K2, respectively. The New York triple valves cannot be converted into the standard K type triple valves. When the F-1, B or S-1, B New York quick action triple valves get worn to point of needing any factory repairs, body cracked, or broken or exhaust opening boss broken, or threads stripped, also when same need a combination of heavy repairs they should be dismantled and bodies broken, scrap brass salvaged and a working stock of good serviceable material be kept for repairing similar valves still in service. For the present type H-1-B. New York will be maintained to take care of foreign equipment, but no factory repairs will be made to this type. On system freight cars K-1 triple valves are interchangeable and can be substituted for F1-B. N. Y. The K2 triple valves substituted for H1-B. N. Y. and on passenger equipment the P2 triple valve substituted for S1-B. the L2 triple valve substituted for J-5 N. Y. When S1 N. Y. triple valve or the compensating valve is no longer serviceable, they should be replaced with the type P2 triple valve and E-3 safety valve. High speed reducing valves should be treated the same as compensating valves.

(iv) When a triple valve is removed from car to be tested before cleaning, turn brake pipe opening down and tap lightly to remove any dirt or moisture so that same will not pass into triple cylinder and test rack when being tested.

(v) All triple valves in any service, as outlined below, must be removed and replaced with valves of duplicate types which have been cleaned, lubricated, repaired and passed all required tests on Standard A. R. A. Test Rack. (a) on locomotives and tenders when inoperative or vehicle shopped for classified repairs; (b) on passenger train cars when found cut out and carded by brakes sticking or inoperative and when by aid of portable test truck or special testing device, valve is found inoperative or not functioning properly according to specified code tests; (c) when vehicle is shopped for repairs, and in addition should be removed and replaced every three months thereafter; (d) on freight cars when found cut out and carded for brakes sticking or inoperative and when by the aid of portable test truck or special testing device, valve is found inoperative or not functioning properly according to specified code of tests; (e) and thereafter each twelve months, or (f) if it is on repair tracks and stencil date shows nine or more months since last cleaning.

All triple valves received from manufacturer must be overhauled and tested before being put into service.

(vi) All points not equipped with standard triple valve test rack, will return the removed triple valves, with the old gasket and *all openings sealed*, to storekeeper for replacement. Local storekeeper will ship them to the nearest shop having a standard triple valve test rack for repair and return.

(vii) On completion of final test, triple valves should be prepared for

shipment or transfer to repair yards by applying a gasket in good condition and metal shipping caps for protecting the flange bolting face and auxiliary reservoir opening, also metal thread protectors for sealing exhaust port and brake pipe connections and stencilled with the symbol of the station doing the work. These protectors should not be removed until immediately before applying triple valve to car and when removed should be applied to the triple valve taken off the car. Shipping caps will be furnished by general storekeeper and will be known as the H, K, and L, type.

Metal thread protectors for all $\frac{3}{8}$ " exhaust openings P. No. 21194.
 Metal thread protectors for all $\frac{1}{2}$ " exhaust or pipe openings P. No. 21195.
 Metal thread protectors for all $\frac{3}{4}$ " exhaust or pipe openings P. No. 21196.
 Metal thread protectors for brake pipe external thread P. No. 57129.

When shipping the "L" type of triple valves, the safety valve must be removed and boxed or wrapped up and properly tagged, and the safety valve opening in triple valve sealed, preferably by special plug P. No. 19052.

(viii) Triple valve removed from car having slid flat wheels or reported sticking, going into undesired quick action, or any other defect, must have a special tag applied stating cause for removal, giving car number and where removed. Triple valve so removed must be tested *before* being dismantled and cleaned, and record of test made, after which valve must be treated as old date valve.

(ix) When cleaning triple valves without laundering vat, a special device for holding or clamping triple valve should be used, so valve will be in such position that all parts will be accessible for removal and cleaning without further handling. (A device for this purpose, is detailed on Drawing No. D-685, available upon application to M. C. B.) In dismantling service parts, remove graduating stem nut, graduating stem spring from cylinder cap, clean the stem guide hole which must be standard bore $\frac{25}{64}$ ". Check stem nut for standard length which is $\frac{19}{32}$ " from end of bearing to flange. Stem must be free from bruises and not distorted, and must work freely in the bore nut. Check graduating stem spring to see that it is standard to type of valve and in good serviceable condition. Remove cylinder cap, ascertain if cylinder cap gasket is serviceable, renew if hard, cracked or pitted at point of contact with main piston. Do not bend sharply as lots of good gaskets are ruined by unnecessary bending. All cylinder cap gaskets removed from triple valves must be saved, tied up in bundles of twenty-five and shipped to Milwaukee shops for reclaiming. Check cylinder cap to see if threads for graduating stem nut are in serviceable condition. Cylinder cap must have enough of flange to insure centering it on valve body, and to support the sections of gasket opposite the brake pipe passage. Rap body of cylinder cap to loosen dirt and scale and blow out thoroughly with compressed air.

(x) Pull main piston and slide valve, if triple valve has the slide type graduating valve, remove slide valve and graduating valve. Immerse in kerosene oil and with a swab of cheese cloth on a stick, thoroughly clean out cylinder bushings, slide valve bushing and its seat. Clean feed groove with box wood or hickory pointed stick, or copper pointed tools. Do not use hard metal tool in feed groove or ports.

(xi) When removing retarding device, check to determine if stem is stuck in its guide by inserting a wooden stick. If stuck loosen with kerosene and make free before attempting to remove.

(xii) When removing check valve case, tap lightly with hammer on bolting flange to loosen check valve case gasket, but do not by pushing, pulling, or striking with hammer move it sidewise because this will bend emergency valve stem. Check valve cases having cast iron seats for check valve should be scrapped. Tap check valve case with hammer and thoroughly blow out. Note that threads at brake pipe connections are in such condition as will insure a tight joint, if not case should be scrapped. Lap each check valve case face to a true and full bearing on a lapping plate made of cast iron machined to an accurate and smooth surface and to which a sheet of emery cloth has been glued. This lapping will show low spots which would cause leakage, as well as remedying such where not very bad. See that a full bearing is had between the recess for emergency valve seat and the brake pipe passage. Special care should be taken to insure emergency seat recess being thoroughly cleaned and of correct depth (.19") so seat when applied will be flush with check valve case. If the recess is deeper than standard the case should be faced off to give the standard depth. Paper washers to remedy this trouble should not be used.

The lost motion between the check valve and its seat bush must not exceed .01" otherwise the valve will not seat true. Grind in check valve with a suitable grinding compound and thoroughly clean valve and seat and blow out with compressed air. Test check valve in its case for leakage with a special device. A device for this purpose is shown on Drawings 12720-1 and 12820-1 which can be obtained from the M. C. B., or discarded clamping device for discarded 2 T. test rack can be used for this purpose.

(xiii) Thoroughly clean emergency piston and its cylinder bush. The emergency piston should never be filed, rubbed on emery cloth, or have any cutting material used. It should fit its bushing and guide so as to pass the A. R. A. triple valve test rack.

(xiv) Clean emergency valve seat but do not flatten by rubbing on emery cloth, as the emergency valve seat should have the standard round bearing $3/32''$ radius. Emergency valve seat should be reclaimed when flat or distorted, providing that the valve bearing will not be more than $1/64''$ below the face of outer flange and guide portion is true with seat. Flat or distorted emergency valve seats should be boxed up and forwarded to the nearest points equipped with a special designed machine for doing this work.

(xv) Emergency valve rubber seat should be removed when pitted or its condition such that it is reasonable to assume that a tight joint cannot be made. Before applying a new rubber seat it is of the utmost importance that the recess for the rubber seat is thoroughly cleaned and free from distortions, so that there will be an even and uniform bearing for a new seat. Rubber seat should be lightly coated with flake graphite before being applied. The emergency valve should be checked in a cylindrical gauge

to ascertain if stem and rubber seat are true. When stem does not enter gauge, due to oversize, it should be reamed to size in a special device which will guide the stem to keep it straight. Where cylindrical gauge does not leave a full bearing on seat after emergency valve has been rotated the emergency valve should be checked in the tool for testing the back of valve. If the stem is bent it should be straightened in a specially designed tool that will not bruise or distort the stem. Points not equipped with facilities for reclaiming emergency valves will box up and ship to Milwaukee shops for reclamation.

(xvi) No lubrication should be applied to the emergency piston, emergency valve or check valve. The vent valve piston of the New York type of triple valves should be lubricated by applying a light coating of suitable high grade oil to the vent valve piston packing ring.

(xvii) The check valve case gasket should be carefully examined to see that the bead is in good condition and should be carefully cleaned without scraping and with both sides lightly coated with flake graphite should be applied to emergency valve seat with beaded side toward face of check valve case.

When assembling coat the thread on bolts or cap screws with graphite grease, and uniformly tighten. Bolts, nuts, or cap screws that have defective threads or which cannot be tightened with standard triple valve wrench must not be used. The use of cold chisel for tightening nuts is not permitted.

(xviii) The slide valve seat and main valve bushing should be cleaned out thoroughly with cheese cloth and all parts thoroughly blown out with compressed air. With a rubber tipped bent special nozzle blow out with compressed air all ports in slide valve seat and bushing, paying special attention to quick service port on "K" type triple valves. Wipe and blow off with compressed air the slide valve, graduating valve and piston, leaving all parts dry.

Note that piston ring groove is clean and that ring moves freely in groove. If ring is stuck, do not use a hard metal tool to free same.

(xix) With the following parts entirely free from oil or grease, lubricate the face and seat of slide valve, and slide type of graduating valve with approved fine high grade dry graphite, rubbing in thoroughly on the slide valve seat, slide valve face, also on the upper portion of the slide valve bushing where slide valve spring bears. Endeavor to have as much as possible adhere to and fill up the pores of the brass leaving a very thin coating of free graphite. Rub in the graphite with a flat stick over the face of which a piece of chamois skin has been glued.

At the completion of the rubbing operation a few light taps of the stick on the slide valve and seat followed by blowing off with a light blast of compressed air, will leave the desired coating of loose graphite.

This special graphite should be kept in the original container, a slot

being cut in the cover which will just allow the chamois covered stick to enter, the stick to be left in the slot as a stopper when not in use.

(xx) In assembling the slide valve and piston great care should be exercised when rivetting the slide valve spring pin in order not to spring the two vertical walls so as to bind the graduating valve.

Avoid undesirable slide valve spring tension; when correct the outer end of spring will be $\frac{1}{8}$ " higher than the bore of the bushing when this end of spring touches the bush lightly, as it enters, without being compressed.

(xxi) The triple piston packing ring and its cylinder should be lubricated with a suitable high grade oil as follows: Insert the piston and its valves in the body, placing the ring opening at the bottom of the cylinder and move piston to release position, then sparingly lubricate the piston cylinder with a drop or two of oil rubbed on with the finger and move the piston back and forth several times, after which remove the surplus oil from the outer edge of the cylinder to avoid leaving a surplus of oil to run on slide valve or its seat, while valve is being handled or stored before going into service.

Apply a coat of dry flake graphite to the face of the bolting flange of the cylinder cap and, apply graphite grease to the graduating stem nut, cylinder cap bolts and threaded portion of retarding device body. Retarding device stem should be free in body to prevent it from sticking in retard release position. The piston stem should strike in the center of the retarding stem when piston is being moved to release position.

(xxii) After cleaning all triple valves should be tested on standard test rack according to the A. R. A. Code of Tests, applying to the type of triple valve being tested.

(xxiii) When triple valve fails to take all tests it should be marked with a symbol indicating the defect or defects to be remedied and must be tested again at completion of repairs. When a triple valve fails to take the prescribed tests for main piston packing ring, it should be determined if bushing needs to be trued up before fitting a new ring. The work of truing piston bushings should be done on a specially designed machine made expressly for that purpose.

This work should not be done by means of reamers, rollers, expanding lapping sleeves, universal grinders or lathes, as the results from such are unsatisfactory. Where truing up the bushing will increase the diameter more than .010" larger than standard, the triple valve should be returned to the manufacturer for restandardizing. The bushings of all repaired triple valves should be checked with an accurate gauge of maximum diameter, and condemned if gauge will enter. It should be known that the feed groove is of proper size and length.

Standard cylinder diameters are:

Types H, K, P, L1, F2, W. A. B. and F1, H1, S1, C, GN1, GN2, K3, K4, K5, and K6, N. Y. A. B.....	3.5"
Types L2A, W. A. B.....	4.0"
Types L3, W. A. B.....	4.75"
Types G-24 and F-25 plain triple valves.....	3"
Types F1, W. A. B. and Style E N. Y.....	3 3/8"

(xxiv) For the present the following types of triple valve bodies will be shipped into main shops at Milwaukee for truing up of piston cylinder bushings, K1, L2, K2, H2, P1, P2, and L3, and also all plain triple valves for locomotives.

When triple valve fails to take piston ring leakage test, shim with paper between the ends of old rings, until a slight resistance is offered to the movement of the main piston close to the outer end of its cylinder. Then steadily move the piston inward, noting whether a material difference or decrease in resistance is met (if existing it will be met at the service travel). If a decrease in resistance is found bushing must be reground.

In preparing for shipment any valve which shows excessive bushing wear in any of the types mentioned, the valve will be entirely dismantled. All parts excepting the body, will be put into a container, and a strong box of proper size and shape procured to take individual valve body.

A small metal tag with symbol of station and a number stamped or imbedded in same will be wired or bolted to check valve case bolting flange. Also a number corresponding with that of marked metal tag will be attached to parts in container.

When body of valve is boxed up, a linen "Repair and Return" tag should be securely tacked on box and marked with ink, "Air Brake Foreman, Car Dept." care of Storekeeper, Milwaukee Shops, and a requisition made to cover, and forwarded through regular channel.

(xxv) Following are the points having test racks and initials to be used for identification: Western Ave., W. A.; Galewood, GAL.; Dubuque, DUB.; Ottumwa, OTT.; Sioux City, S. C.; Atkins, A. T.; Green Bay, G. B.; LaCrosse, LAX.; Minneapolis, MPLS.; Aberdeen, A. B.; Miles City, M. C.; Harlowton, HAR.; Deer Lodge, D. L.; Othello, OTH.; and Tacoma, TAC.; Terre Haute, T. H.; Savanna, SAV. These initials are to be used by air brake shops only.

(xxvi) All main pistons should be tested on centers to make certain that they are true and not bent.

When a new packing ring is to be applied ascertain: First, if new ring is a close but free fit in the groove, by inserting and rolling its outside edge in the groove. Second, that the ring is of uniform thickness by revolving it in one section of the piston groove while the piston is held stationary. Third, that the ring groove is of uniform width, by holding the ring stationary and revolving the piston on one section of the ring.

Packing rings, if once removed from the piston and found distorted, in any manner or out of round, should be scrapped. Packing rings, without tension, open at cut when in their cylinders, a loose fit in ring groove or bent in any way, should be scrapped. When fitting ring to cylinder care should be taken to keep the ends of ring parallel and in line with center of ring, keeping them as close together as possible but must not overlap. When necessary to fit the ring to the groove, a lapping plate as already described, on which No. 00 carborundum cloth has been glued, should be used. The thickness of the ring should be reduced on one side only. The fit of ring in the groove should be such that a seal will be formed by face of groove on both sides of ring with no lost motion. Packing rings should be ground into its cylinder before the valves are assembled, and with slide valve removed from piston. The rubbing in process should be done with a free use of thin lubricating oil and not with any grinding compound. As the oil becomes gritty and black the piston cylinder walls must be wiped clean and new oil applied. This being repeated as necessary until the ring is thoroughly ground in. When ring is ground and valve assembled the ring opening should be left at the top and away from feed groove. After grinding and before valve is assembled, the resistance should be measured with the friction indicator, which should not exceed 5 pounds for the piston and ring alone or 6 pounds with slide valve attached.

(xxvii) Piston ring grooves worn to such an extent that a new ring cannot be fitted to pass the test, should not be scrapped but should be forwarded to Milwaukee shops for reclamation.

Slide valve and seat should be trued up by means of special safe edge files or bars on which carborundum cloth has been glued, and then spotted to a true face plate and spotting bar. Do not use slide valve as a face plate for truing up seat. The face of valve and seat to be true and square with end of valve and bushing. They then should be rubbed together with oil for finishing with slide valve attached to a bar. Do not use any method of grinding in or wearing in with the slide valve attached to the piston. In rivetting the slide valve spring pin of a triple valve using the slide valve type of graduating valve be careful and do not spring the two vertical walls so as to bind the graduating valve. The slide valve spring should be known to be the proper spring for the type of valve being repaired and free from corrosion or wear that would cause it to fail before next cleaning period.

Avoid undesirable slide valve spring tension; when correct the outer end of spring will be $\frac{1}{8}$ " higher than the bore of the bushing when this end of spring touches the bush lightly as it enters, without being compressed.

Under no circumstances should the edge of slide valve seat be chamfered off with a file.

Condemning depth of exhaust in slide valves in Westinghouse Triple Valves:

G-24	F-25	F-1 (H-24)	F-2 (H-36)	H-1 (F-36)
$\frac{3}{32}$ "	$\frac{5}{32}$ "	$\frac{5}{32}$ "	$\frac{5}{32}$ "	$\frac{5}{64}$ "
H-2 (F-49)	K-1	P-1	P-2	
$\frac{1}{8}$ "	$\frac{1}{8}$ "	$\frac{1}{8}$ "	$\frac{9}{32}$ "	

(xxviii) Repair the slide valve type of graduating valve and its seat the same as main slide valve seat. Rub, wear or grind in the round or pin valve type of graduating valves as conditions indicate necessary and test all graduating valves by so called "Lip Test" for leakage. The graduating valve pin should be so located that in movement to release position, the thrust will come on shoulder of the main piston and not on the pin, the pin to be free in the hole of graduating valve.

(xxix) The triple valve exhaust port should be tapped out and checked with a standard pipe tap of the plug type which has a stop so located that it will enter just enough for a full thread; this will clean up threads and permit retainer pipe to enter the proper distance. If inspection shows that the tap is then loose or if some of the threads are broken or excessively worn, the boss should be faced off $1/8''$ and tap again used. If this does not permit of a tight joint with standard thread the port must be reamed, and bushed. Both exhaust port openings must be maintained in serviceable condition.

(xxx) Targets indicating "K" type of triple valves should be replaced where broken or lost. (Proper reference for obtaining same to replace are: piece number 68485—steel target, and piece number 23372—fillister head screw for attaching same, two screws are required for each target.)

(xxxi) At present emergency valve seats are reclaimed at Milwaukee shops, Galewood, Minneapolis, Aberdeen, Deer Lodge and Tacoma. This work requires a specially designed tool in which the checking should be such that the refinished round bearing of $3/32''$ radius, for emergency valve will be absolutely parallel with the outer finished surface of the seat and not cut below $1/64''$ of the face of outer flange, and guide portion is true with the finished seat. The emergency valve seat should never be ground, filed or rubbed flat on emery cloth, as this will flatten the seat and throw it out of square, when it becomes equivalent to a bent emergency valve stem. When all of repairs have been made complete, the triple valve should be properly lubricated, as outlined previously and valve assembled; before going into service triple must pass the A. R. A. Triple Valve Test Rack, using proper code applying to the type of triple valve to be tested.

(xxxi) The most prolific cause of disorders in the triple valve is dirt or foreign matter getting into it, or the valve becoming dry and gummy, or excessive lubrication due to oil and water getting into it from the brake pipe. The slide valve, graduating valve, or body gasket leaking will cause a blow at the exhaust port, from the auxiliary reservoir. Leaky valve will usually cause a blow in either release or application positions. This might also be true of the graduating valve. A leaky body gasket will usually cause a blow when the triple valve is in release position. A leak from the auxiliary reservoir is a waste of air and tends to release the brake after it has been applied. The emergency valve rubber seat or the check valve case gasket will cause a blow at the exhaust, from the brake pipe, but only when the triple valve is in release position. A leak by the emergency valve or check valve case gasket is a waste of air when the brake is not applied, and when the brake is applied, it causes the brake cylinder pressure to build

up when a light application has been made and frequently causing damage to the wheels. If a buzzing or humming sound is heard within the valve after the auxiliary reservoir is fully charged, it is caused by an emergency valve leaking, or leakage from auxiliary or supplementary reservoirs. When undesired quick action occurs during service applications, it is caused by the valve being dry or gummy, and might be caused by a weak or broken graduating spring, although this would depend on the condition of the triple valve and the rate of brake pipe reduction. It might also be caused by the by-pass valve failing to seat. If the piston packing ring is not a good fit in its cylinder it will allow the air from the brake pipe to pass by the piston into the auxiliary reservoir and may cause the brakes to fail to release. If the triple valve piston does not make a good joint against the cylinder cap gasket when in emergency position, it will permit auxiliary reservoir air to leak by the piston into the brake pipe, thus affecting the efficiency of the brake. Check valve leakage will permit the brake cylinder and auxiliary reservoir air to leak back into the brake pipe whenever the brake pipe pressure has been reduced below the equalizing point, regardless of whether the brake has been applied in service or emergency and will therefore effect the efficiency of the brake. If the by-pass valve leaks, it will permit air from the supplementary reservoir to flow to the auxiliary reservoir during service applications and would result in heavier brake applications than was desired. If the leak is a heavy one or the by-pass valve is held off its seat, it will cause a sudden, full service application with light reductions, and may cause undesired quick action. Leakage past the by-pass valve can be caused by a weak spring, or tight fitting piston. The by-pass valve only operates during emergency applications and as soon as the supplementary auxiliary and brake cylinder pressures equalizes the spring back of the valve forces it shut. If the spring is weak or the piston too tight the valve may not return to its seat. If the triple valve fails to graduate the release of the brake it is due to a dry or gummy valve or leakage, from the supplementary reservoir or packing ring leakage. The safety valve should be cleaned and tested at the same time the triple valve is cleaned and tested. The safety valve strainer should also be cleaned. No lubrication should be applied to the operating parts of the safety valve. The function of the exhaust regulating ring is to regulate the size of the opening through the ports in the valve body in order to control the range between opening and closing of the safety valve. The lock ring is to hold the exhaust regulating ring securely in its proper position. Adjustment is made by means of the regulating nut on top of the spring. The safety valve should be adjusted to open at 62 pounds and close at 58 pounds. When the valve has been adjusted with the regulating nut to open at 62 pounds, the range between opening and closing should be regulated by screwing the regulating ring down or up until the exhaust ports have the proper opening to cause the valve to close at 58 pounds.

Sub-para. (X) .

GENERAL INFORMATION

On all trains it is necessary that at least 85% of the brakes are "operative." A brake may be "operative" but still "inefficient." Our standard is to have not less than 85% brakes efficient—where facilities are

good the percentage is to be 100 other than under circumstances such as would arise from exceptionally heavy business, or from loss or claims due to delay. An "inefficient" brake is one where the brake has 10 inches or more piston travel, where car is non-air, where brake is cut-out or does not apply with the test application or leaks off in less than specified time.

To cut out the brakes on a car, close the cut-out cock in the branch pipe to the triple valve, and exhaust all of the air from the auxiliary and block the release valve open. If a passenger equipment car leave the auxiliary reservoir and supplementary reservoir drain cocks open. Do not cut out any brake because it fails to apply or leaks off. Cars having the air brake cut out where no visible defect exists, and with no defect card attached, should be cut in.

When applying the air brake defect card it should be applied only as a last resort by inspectors in assembling yards; if however, the defects cannot be repaired the card should be attached to branch pipe near the triple valve and the particular defect for which the brake is cut out must be marked on the card.

They are a factor of efficiency, and fully 50 per cent better results can be obtained by their universal use than without them. Car foremen at all points will see that a supply of these tags is available, and will positively insist upon their use upon occasions mentioned, if necessary taking men out of service where they deliberately fail to card a cut-out brake. This instruction will be sufficient authority for foremen taking such action.

Before adjusting piston travel, applying brake shoes, or doing any work on the rods or levers, the brake must, if charged, be cut out and auxiliary reservoir drained. Angle cocks are open when the handle is in line with the hose and closed when handle is crosswise with the hose.

All cut-out cocks are open when the handle is crosswise of the pipe and closed when it is in line with the pipe.

Cocks without handles have a groove in top of key plug and when this groove is crosswise of the pipe the cock is closed, when in line with the pipe the cock is open.

In applying air hose gaskets the groove in the hose couplings must first be cleaned out to admit the gasket. Trimming the gaskets in order to have them enter the groove is not permissible.

When L. N. equipped cars are to be operated in freight trains, they should have their supplementary reservoirs cut out, drained and drain cocks left open and any passenger car hauled in freight train should have brakes adjusted to 8 inches.

When cutting off engine, always close both angle cocks where the separation is to be made, and uncouple the air hose by hand.

The different makes and types of triple valves may be distinguished by observing the following:

There are two different makes of triple valves in general use, viz.: Westinghouse and New York. The make of the triple valve can be distinguished by noting whether check valve case is detachable or not.

All Westinghouse freight and passenger triple valves have the lower part or check valve case attached by means of bolts and nuts, or cap screws. All New York freight or passenger triple valves have lower part or check valve case cast integral with valve body. Only those triple valves having detachable check valve cases can be converted to the "K" type. The Westinghouse freight triple valves are made in two sizes. Size No. 1 is attached to the reservoir with two studs. Size No. 2 with three studs. Of the former or No. 1 which is used with 8" equipment there are three common types, F-36, H-1 and K-1, the check valve case being attached to body of valve by two cap screws. The outward appearance of F-36 and H-1 are the same. The former, F-36 is now obsolete and superseded by H-1. The K-1 has a cast fin or lug on the top of the body of the valve to designate it from the H-1 when attached to the reservoir. When an H-1 has been converted to the K-1 type this fin or lug is attached to top by means of machine screws. The No. 2 Westinghouse valves in freight service are used with 10" equipment and known as H-2 and K-2. These have the check valve case attached to body of valve by four bolts and nuts. The designating mark for the K-2 when attached to the reservoir is the same as the K-1. Westinghouse passenger triple valves of the P-1 and P-2 types are connected from branch pipe to check valve case and have an exhaust port on one side only. The L-1, L-2, and L-3, also PC and UC, have pipe connections. The New York triple valves in freight service are known as F-1, H-1, G-N1, G-U2, K-3, K-4, K-5, and K-6. The F-1, GN-1, K-3, and K-5 are used with 8" equipment and are attached to reservoir with two studs and as a rule the type of valve is designated by a symbol cast on body. The H-1, GN-2, K-4 and K-6 are used with 10 inch equipment and are attached to reservoir with three studs. Of the passenger triple valve of the New York make, the S-1 is connected from branch pipe to triple valve proper, while J-5 and J-6 have no pipe connections.

Para. 12. GENERAL PROCEDURE FOR INSPECTION AND RUNNING REPAIR OF PASSENGER CARS

The necessity for thoroughness in the inspection and repair of passenger train equipment must at all times be kept uppermost in the minds of those assigned to this work. Our railroad has a number of famous trains such as the Pioneer Limited, the Southwest Limited, and the Olympian, which are regarded as nationwide public facilities, and which are bulwarks in the prestige of the Milwaukee Railroad. These trains must be kept efficient to maintain their reputation, and eternal vigilance is the price of efficiency.

While the trains mentioned, in addition to other first-class trains, reflect favorable public opinion upon the road, they also serve to throw into sharp relief any poorly kept equipment which we allow to go into service. Railroad conditions and our available facilities will not always permit the shopping of equipment as frequently as our routine provides, but these are factors beyond our jurisdiction. The keeping of equipment thoroughly clean and in safe condition, however, are matters almost entirely within our control, and it is in this direction we must at all times obtain the best possible results.

Many factors enter into obtaining the best results, but the greatest contributor is the live interest and personal pride of those who handle the equipment at destination and starting point. We have one or two branch line trains that are favorably commented on by travellers, and in each instance it is found that the staffs preparing it for service are proud of the train and its reputation, and their work on it is regulated accordingly. This spirit should be created and encouraged, by giving credit where it is due, making clear to those concerned what is wanted and showing them how it can be obtained, and then insisting on results of the required standard.

But the need for thoroughness is not merely a matter of advertisement, or making passengers comfortable—it is largely a question of safety. The lives of hundreds of travellers are daily dependent upon the vigilance of our inspectors, and in the rush that sometimes precedes the departure of a train on time the margin of safety must never be overlooked. A railroad can never hope to prosper that will allow an inspector to expose passengers to risk of accident, through carelessness, ignorance, or lack of initiative.

Passenger cars will be subjected to three classes of inspection. No. 1 will consist of a thorough examination of each individual car, and will be given in yards prior to the making up of trains. This will include test of all air brakes. No. 2 Inspection will be given trains enroute at Divisional Repair points, and will consist of examination of the cars as set out in the instructions for Inspection of Passenger Cars in Trains, and is to include a standing air brake test. At small intermediate points trains will be given a No. 3 Inspection, which is to include quick but careful examination of foundation brake rigging, attention to hot boxes, and a standing air brake test. Inspectors making this class of inspection must be ever on the alert to detect any other class of defect, especially cracked equalizers or broken springs.

Para. 13. INSPECTION AND REPAIR OF PASSENGER CARS IN COACH YARDS

Sub-Para. (I)

INSPECTING

Obviously the place to inspect a car and make repairs to it—other than heavy shopping repairs—is in the Coach Yard. Every physical part of the car must be looked over, air brakes tested, light and heating systems examined, and necessary repairs and adjustment made so that when the equipment goes into service it will make its required journey without delay or inconvenience.

The requirements in connection with safety appliances, wheels, axles, and air brakes must be complied with. Inspection of tail pins must be made at periods of *not more* than 90 days, and record of the inspection made on the 2" diameter metal disk attached to car for that special purpose. This record will show date, station, and inspector's number. Any pins found worn unduly must be replaced at once. *This is a most important matter*, as failures, heavy delays, and possibly damage to equipment will result from any neglect to comply with the rule.

At some yards train must be inspected immediately on arrival, in order to ascertain whether there are any hot boxes, but where trains are looked over at the depot and then pushed into yard, this is not necessary, as hot boxes will be plainly marked with chalk.

Once a month an inspection must be made of the interior of sleeping cars and contents checked. Record of check will be made on form 679, which will be found in a receptacle located on the inside of the equipment locker door. Record will include date and place of checking, and any shortages found are to be taken up at once so that responsibility may be established: articles will be replaced immediately following inspection. The items to be checked include step boxes, blankets, hotel books, chairs, berth curtains, portieres, screens, deflectors, fire extinguishers, tail gates, hassocks, berth hammocks, candle lamps, screen hooks, step ladders, mattresses, sash openers, fire pokers, pillows and covers, screens, fire shovels, grate shakers, spittoons, camp stools, section tables, etc.

The time spent in making this check will be charged to account 403.

When making this monthly inspection the check of screens and deflectors is to be made a special feature, and it must be seen that any shortage is replaced at once.

Sub-Para. (II)

REPAIRING

The packing in all journal boxes is to be stirred up, and where needed fresh packing will be added. Free oil will be applied where quite necessary.

Hot boxes will be given proper attention, and journal box lids applied if missing. It is a positive policy that all cars be equipped with journal box lids, and that they be a good close fit.

Piston travel must be adjusted, brake shoes replaced or reversed, side

bearing heights corrected, foundation brake rigging and draft gear tightened, coupler heights corrected, etc.—

Any work necessary must be done to put the following in order:—Centering device, heating, drip, steam, air and signal hose or gaskets, fastening of electric generators, location of dynamo belts, battery box doors, etc. Side bearings and center plates are to be greased every sixty days. Air and signal hose is to be tested every thirty days. (Soap suds test.)

With the approach of summer passengers want windows open, and at this time of year yard forces must pay particular attention to the condition of sash locks and stops, in order to prevent the claims for injury that otherwise result from defective apparatus.

The steam pipes of baggage express cars must be looked over and any leaks properly fixed before car goes into service. In many cases damage results from leaking pipes or valves, and in some instances the whole content of a baggage car has been ruined. Contents sometimes consist of theatrical baggage of great value, and when car is sealed there is little prospect of detecting a steam leak enroute.

In order to extend the period between shoppings for heavy repairs, and to keep cars in the best possible condition both physically and in appearance, at all terminal coach yards it will be a regular routine to paint floors, ceilings, wainscoating, vestibules, doors, roofs, etc. of passenger cars. At the same time minor repairs accompanying such painting will be given effect to.

Door checks must be regulated so as to allow doors to swing within 4 inches of frame and then close slowly with door check in action. Where it is found that doors swing too slowly or too fast, adjustment must be made by turning ratchet wheel two or three teeth, with special wrench, and again locking it by sliding ratched in main arm. Checking action must be adjusted by screw located to the right of the check, turning same to the right hand when door closes too fast, and to the left hand when door closes too slowly. When check fails to operate, remove for repairs. Door checks must be inspected and adjusted, when necessary, before cars leave originating terminals. To recharge check cylinder, mix one-third wood alcohol and two-thirds glycerine; lubricate spring with grease.

The back up hose on all passenger trains must be coupled to the brake pipe on the rear car *by the carman* before train leaves coach yard at the initial terminal, and remain with the train until arrival at the final terminal. It must be seen that air is cut in ready for immediate service, and hose so hung that it will not fall off. If conductor or brakeman desire air cut off from back-up hose, it will be cut off again by the brakeman—not the carman.

On trains having an observation or private car on rear end, equipped with permanent back-up pipe, a back-up hose will be placed in baggage car to be available for use in the event of the car having permanent back-up

pipe being cut from train. If the observation or private car is cut off at a terminal or divisional inspection point the carmen will see that the back-up hose is coupled to brake pipe on rear car.

Sub-Para. (III) EXAMINATION BEFORE DEPARTURE

Before a train finally leaves the coach yard, it must be looked over carefully. At large points this will be done either by a specially competent inspector or by a foreman. The need for this final examination is very great, as no matter how carefully a train has been inspected, repaired, and prepared for service, it will be found when looked over to have a number of small items missing, incomplete, and requiring adjustment. Their correction is what counts.

In going over the train the following matters should be borne in mind, apart from the ordinary physical inspection.—In passing through interior of cars see that nothing is left lying about, that all lamps or electric lights are in order, that ventilator stick is available, and *that loose equipment in baggage, dynamo baggage, coaches or chain cars—as the case may be—is correct.* This matter must be followed up vigorously at all times, and positive steps taken to see that cars never proceed without wrecking tools.

In going over exterior of cars it should be noted whether cotter pins have been applied where any work has been done to rigging, and that nothing has been taken down and not replaced. *See that tail-light brackets are on rear car.* Each point will in time learn what particular items to watch for, but trains should not be allowed to leave for the depot without this final look-over.

Trains must not be permitted to leave coach yards for service with glass broken, lamp chimneys, globes etc. missing, as such action creates a very bad impression and does the railroad inestimable damage. When material is not available, the matter must be taken up most vigorously by the Foreman, and initiative should be displayed, as no matter how much we are handicapped by the inability of other departments to supply our needs, the responsibility for trains being kept up to standard is primarily ours.

The equipment for the various classes of cars is published for information and ready reference:—

<i>Dynamo Baggage Cars</i>		
Amount	Material	Location
1	Air Brake Hose Complete with Fittings and Gasket	Rack
1	Air Signal Hose Complete with Fittings and Gasket	Rack
3	Steam Hose (Heavy) Complete with Fittings and Gasket.....	Rack
1	Brass 4¼" x 8".....	Special Box
1	Brass 5" x 9".....	Special Box
1	Brass 5½" x 10".....	Special Box
1	Broom (Second Hand).....	Clothes Locker
3	Snow Shovels (November 1st to April 1st) ..	Rack

1	Cold Chisel	Lower Section of Clothes Locker
1	Hammer	Lower Section of Clothes Locker
1	Monkey Wrench (15")	Lower Section of Clothes Locker
1	Cook Cooler.....	Rack
1	First Aid Package.....	Special Box
1	Pair Frogs, with 6 spikes attached to each..	Lower Section of Clothes Locker
1	Combination Jack Block and Wheel Holder..	Lower Section of Clothes Locker
1	Jack Lever and Jack (12" Screw).....	Lower Section of Clothes Locker
1	Hein Knuckle (No. 3 MCB).....	Lower Section of Clothes Locker
1	Ohio Knuckle.....	Lower Section of Clothes Locker
1	Pitt Knuckle.....	Lower Section of Clothes Locker
1	Emergency Knuckle	Lower Section of Clothes Locker
1	Knuckle Pin for Ohio.....	Lower Section of Clothes Locker
1	Knuckle Pin for Hein.....	Lower Section of Clothes Locker
1	Packing Hook.....	Special Box
1	Packing Iron.....	Special Box
1	Pail of Prepared Packing.....	Special Box
1	Air and Steam Hose Wrench.....	Rack
1	Step Ladder	Rack
1	Stretcher	Rack
1	Switch Chain	Lower Section of Clothes Locker
1	Vacuum Cleaner (Coast Line Cars Only)....	Lower Section of Clothes Locker
1	Ventilator Stick.....	Lower Section of Clothes Locker
1	Set of Wrecking Tools, including Axe, Saw, Sledge and 2 Water Buckets.....	Tool Locker

In addition Dynamo baggage cars will carry any electrical equipment and train connectors. On arrival of a car at extreme terminal the equipment will be checked by the Car Inspector with the Train Baggage man. When the car leaves it will be checked by the Inspector and outgoing Train Baggage man. Enroute, where Train Baggage men are changed the equipment will be checked jointly by the incoming and outgoing man, and unless done the incoming man will be responsible for shortages.

Form CD—18 will be used for recording these checks, and record must be made in full—not using ditto marks.

Through Baggage Cars

Amount	Material	Location
1	Air Brake Hose Complete with Fittings and Gasket	Rack
1	Air Signal Hose Complete with Fittings and Gasket	Rack
1	Steam Hose (Heavy) Complete with Fittings and Gasket	Rack
1	Brass No. 7 (3¾" x 7") (Except that Coast Line dynamo baggage cars need not be fitted with No. 7 brasses).....	Special Box
1	Brass 4¼" x 8".....	Special Box
1	Brass 5" x 9".....	Special Box
1	Brass 5½" x 10".....	Special Box
1	Broom (Second Hand).....	Clothes Locker
3	Snow Shovels (November 1st to April 1st) ..	Rack
1	Cold Chisel	Lower Section of Clothes Locker
1	Hammer	Lower Section of Clothes Locker
1	Monkey Wrench (15")	Lower Section of Clothes Locker
1	First Aid Package	Special Box
1	Pair Frogs, with 6 Spikes to each.....	Lower Section of Clothes Locker
1	Combination Jack Block and Wheel Holder..	Lower Section of Clothes Locker
1	Jack Lever and Jack (12" Screw).....	Lower Section of Clothes Locker

1	Hein Knuckle (No. 3 MCB).....	Lower Section of Clothes Locker
1	Ohio Knuckle	Lower Section of Clothes Locker
1	Pitt Knuckle	Lower Section of Clothes Locker
1	Emergency Knuckle	Lower Section of Clothes Locker
1	Knuckle Pin for Ohio.....	Lower Section of Clothes Locker
1	Knuckle Pin for Hein.....	Lower Section of Clothes Locker
1	Packing Hook	Special Box
1	Packing Iron	Special Box
1	Pail of Prepared Packing.....	Special Box
1	Air and Steam Hose Wrench.....	Rack
1	Step Ladder	Rack
1	Stretcher (Coast Line Cars only).....	Rack
1	Switch Chain	Lower Section of Clothes Locker
1	Ventilator Stick	Clothes Locker
1	Set of Wrecking Tools, including Axe, Saw, Sledge and 2 Water buckets.....	Tool Locker

Branch line Wooden Baggage Cars

Amount	Material	Location
1	Air Signal Hose Complete with Fittings and Gasket	Rack
1	Air Signal Hose Complete with Fittings and Gasket	Rack
1	Steam Hose (Heavy) Complete with Fittings and Gasket	Rack
1	Brass 3¾" x 7".....	Special Box
1	Brass 4¼" x 8".....	Special Box
1	Broom (Second Hand).....	Clothes Locker
3	Snow Shovels (November 1st to April 1st) ..	Rack
1	Cold Chisel	Lower Section of Clothes Locker
1	Hammer	Lower Section of Clothes Locker
1	Monkey Wrench (15").....	Lower Section of Clothes Locker
1	First Aid Package.....	Special Box
1	Pair Frogs, with 6 spikes attached to each..	Lower Section of Clothes Locker
1	Combination Jack Block and Wheel Holder..	Lower Section of Clothes Locker
1	Jack Lever and Jack (12" Screw).....	Lower Section of Clothes Locker
1	Hein Knuckle (No 3 MCB).....	Lower Section of Clothes Locker
1	Pitt Knuckle	Lower Section of Clothes Locker
1	Ohio Knuckle	Lower Section of Clothes Locker
1	Emergency Knuckle	Lower Section of Clothes Locker
1	Knuckle Pin for Ohio.....	Lower Section of Clothes Locker
1	Knuckle Pin for Hein.....	Lower Section of Clothes Locker
1	Packing Hook	Special Box
1	Packing Iron	Special Box
1	Pail of Prepared Packing.....	Special Box
1	Air and Steam Hose Wrench.....	Rack
1	Step Ladder.....	Rack
1	Stretcher	Rack
1	Switch Chain.....	Lower Section of Clothes Locker
1	Vacuum Cleaner (Coast Line cars only)....	Clothes Locker
1	Ventilator Stick	Clothes Locker
1	Set of Wrecking Tools, including Axe, Saw, Sledge and 2 Water Buckets.....	Tool Locker

Coaches, Chair Cars, etc.

Amount	Material	Location
1	Set of Wrecking Tools inside of car, con- sisting of 1 Axe, 1 Saw, 1 Sledge, 1 Pinch Bar (in steel cars only) and 2 Water Buckets	Special Locker
1	Step Box	In Toilet Room

- | | | |
|---|--|------------------|
| 1 | Step Ladder | Rack |
| 2 | Corduroy Vestibule Diaphragm Curtains for wooden cars only, with Hinged Vestibule Diaphragm Posts, etc..... | Equipment Locker |
| 1 | Set of Wrecking Tools Outside of Car, consisting of 1 Axe, 1 Saw, 1 Sledge, 1 Pinch Bar (in steel cars only) and 2 Water Buckets | Special Locker |

Cabooses

Amount	Material	Location
2	Air Hose	Locker under Desk
6	Air Hose Gaskets	Locker under Desk
1	Axe	Locker under Desk
1	Brasses 4½" x 8".....	Locker under Desk
1	Brasses 5" x 9".....	Locker under Desk
1	Brasses 5½" x 10".....	Locker under Desk
1	Broom	Locker under Cupola
1	Bucket (Fibre).....	Under Cupola
1	Cable ⅞" with Hook and Link.....	Tool Box under Car
1	Chair	At Desk
1	Cold Chisel.....	Locker under Desk
1	First Aid Package (Wis. and passing through)	Locker under Desk
1	Flags (Torpedo)	Locker under Cupola
1	Flage (Red).....	Locker under Cupola
1	Pair Frogs with 6 spikes attached to each..	Tool Box under Car
12	Fuses	Special Box
1	Globes (White)	Locker under Cupola
1	Globes (Red)	Locker under Cupola
1	Hand Hammer	Locker under Desk
1	Journal Jack	Locker under Cupola
1	Jack Black and Wheel Holder.....	Locker under Cupola
1	Knuckle (Emergency)	Tool Box under Car
1	Knuckle Pin	Tool Box under Car
2	Lamp Wicks	Locker under Cupola
1	Lamp Filler	Locker under Cupola
4	Lanterns (White)	Locker under Cupola
1	Lantern (Red)	Locker under Cupola
1	Lights (Cupola)	In Fixture
2	Lights (Markers)	In Fixture
1	Box Safety Matches, Safety Fuse and Match Box	Special Metal Container
1	Monkey Wrench (15").....	Locker under Desk
1	Oil Can (Kerosene) 2 gal.....	Oil Locker under Cupola
1	Oil Can (Signal) 2 gal.....	Oil Locker under Cupola
1	Packing Hook	Oil Locker under Cupola
1	Packing Iron	Oil Locker under Cupola
1	Saw (Hand) (lines West only)	Locker under Cupola
1	Steel Bar (4 ft. Pointed)	Under Seats
1	Switch chain ⅞" or 1 "	
<i>or</i>		
1	Cable ⅞" with Hook	Tool Box under Car
12	Torpedoes	Special Metal Container
1	Wash Basin (Tin)	In Washstand
2	Lbs. Waste (Cotton)	Oil Locker under Cupola

These items will be supplied when leaving shops, or at home terminals, and will be kept under seal in cars.

The cleaning, icing, and watering of cars is covered by Section 4—"Standard Practices."

Para. 14. INSPECTION AND REPAIR OF PASSENGER CARS IN TRAINS

Sub-Para. (I) METHOD AND PREPARATION

Even at terminals where trains are made up and given a No. 1 inspection, they will upon arrival in the depot, be looked over in accordance with the requirements for a No. 2 inspection, which are set out in this paragraph. Trains arriving at or passing through Divisional Repair points will be given a No. 2 inspection, and Intermediate points a No. 3 inspection.

To successfully handle this inspection No. 2 Inspection points must be in readiness prior to arrival of train. For this purpose emergency trucks are provided at the following places:—

Aberdeen	2	Green Bay	1	Minneapolis	2
Austin	1	Harlowton	1	Mitchell	1
Avery	1	Jackson	1	Mobridge	1
Butte	1	Janesville	1	Montevideo	1
Calmar	1	LaCrosse	2	New Lisbon	1
Canton	1	Lewistown	1	Othello	1
Cedar Falls	1	Madison	1	Ottumwa Jct.	1
Channing	1	Malden	1	Perry	1
Chicago	1	Manilla	1	Portage	1
Cle Elum	1	Marion	1	Savanna	2
Corliss	1	Marmath	1	St. Paul	1
Davenport	1	Mason City	1	Sioux City	1
Davis Jct.	1	Milbank	1	Spencer	1
Deer Lodge	1	Miles City	1	Spokane	1
Dubuque	1	Milwaukee	2		

When trucks are opened, inspectors must replace the material at once, making proper report of that which has been used, and see that truck is again locked, complete, ready for further use, in accordance with stencilled instructions on each truck. These trucks are to be kept painted and in good order.

Each truck will contain:—

No.	Item
2	Journal box jacks
2	Journal box jack boards
2	Journal box jack levers (pinch bars)
2	Packing hooks
2	Packing irons
1	Pail prepared packing
1	Empty packing pail
6	Brake shoe keys
3	Brake shoes
	Spring cotters (various sizes)
1	Brass 4¼" x 8"
2	Brasses 5" x 9"
1	Brass 5½" x 10"
2	Brake connection pins, 1⅛ inch
2	Brake connection pins, 1¼ inch
2	Brake connection pins, 1⅜ inch
1	Knuckle pin, cotter and washer
1	Bearing wedge, 5½ inches x 10 inches

- 1 Bearing wedge, 5 inches x 9 inches
- 1 Bearing wedge, 4 $\frac{1}{4}$ inches x 8 inches
- 12 Standard nuts, each $\frac{7}{8}$ inch, $\frac{3}{4}$ inch, $\frac{5}{8}$ inch
- 12 Lock nuts, each $\frac{7}{8}$ inch, $\frac{3}{4}$ inch, $\frac{5}{8}$ inch
- 1 12-inch pipe wrench
- 1 Steam and air hose wrench
- 3 1 $\frac{1}{4}$ -inch train pipe nipples and couplings
- 3 1-inch train pipe nipples and couplings
- 2 Combination air and signal hose couplings
- 1 Small roll $\frac{1}{8}$ -inch wire
- 6 Air brake defect cards
- 1 Signal hose
- 3 Air hose
- 3 Steam hose
- 1 1 $\frac{1}{4}$ -inch angle cock complete
- 6 Steam hose gaskets
- 6 Air hose gaskets
- 2 Signal hose gaskets
- 1 Cold chisel
- 1 Hammer
- 1 Small drift
- 1 Bracket for blue flag marker
- 1 Bracket for blue lantern
- 1 Screw driver
- 1 Gallon can of free oil
- 6 Wooden oil box lids (various sizes)
- 6 Pieces second-hand carpet to use as box covers
- 4 Bolts $\frac{1}{2}$ inch x 6 inch—3-inch tread with nut and washer and lock nut
- 12 Tee head pedestal tie strap, bolts with nuts and washers
- 1 Coupler tail pin complete
- 1 Ohio knuckle lock complete
- 1 Uncoupling lever clevis complete
- 1 Brake chain clevis complete
- 1 Monkey wrench
- 2 White pine reservoir drain plugs

On arrival of trains and while entering yard or depot, two of the inspectors should stand in a position so that the entire train passes them, as flat wheels can be thus more readily detected, as well as anything that may be dragging. When train comes to a stop brakes will be applied, engine cut off, and blue flag or light displayed in accordance with Operating Rule 26. The chief inspector should at once obtain from the conductor the 975 report, to see whether there has been any trouble en route, and if so that part of the train should be given immediate attention. Failing any such emergency, inspectors will proceed over the train in the ordinary way, inspecting from both rear and head ends until they meet. Should cuts in the train have to be made, or the engine coupled on before inspection is complete, oil box lid should be left open to mark point at which inspection was interrupted.

Sub-Para. (II) SAFETY APPLIANCES, WHEELS, AXLES, AND BRAKES

The requirements for these parts are fully set out in paragraphs 8, 9, 10, and 11 of this section.—A sharp look-out must always be kept for cast iron wheels under passenger cars requiring steel wheels.

In going over trains, inspectors will examine cars in accordance with the following:

Sub-Para. (III)

JOURNALS

The inspection of journals and handling of hot boxes is covered in para. 4 of section 4. On passenger trains the matter of lubrication must be given considerable attention, as one of the most important items in the cool running of journals is intelligent, systematic, and regularly established attention to packing in boxes on equipment in service.

This briefly consists in lightly loosening up the packing with the packing iron to avoid the hardened and glazed condition which results when packing has remained too long in direct contact with the journal. This is not to be interpreted to mean that passenger trains in service are to have packing poked up more often than once in every five hundred to one thousand miles run, as otherwise it will result in it becoming all cut to pieces through continual jabbing and mechanical wear and tear. In explanation, trains on coast line runs may have the packing loosened up so as to come in contact with the journal, or turned over with the standard packing iron, at Aberdeen and Deer Lodge, besides at originating terminals. It is the intention to change the packing in journal boxes under passenger cars once a month, and as the date is clearly stenciled on the truck sides showing when removal was last made, it will be necessary for Car Inspectors to follow this closely, and in case this is not being given the attention required, they are to notify their immediate superior of such fact. Car Inspectors are cautioned to examine the ends of journals at the centering hole to see whether they present a dry condition. If so, it is a certain indication that something is wrong and brass should be removed and examined.

It is difficult to make a set rule regarding the use of free oil in principal trains, but under certain circumstances it should be employed at extreme terminals and intermediate points which should be determined by the season of the year, condition of the road bed, etc. At intermediate stations such as Aberdeen, Sioux City, Mason City, Deer Lodge, Othello, Miles City, etc. only one of the inspectors, or an oiler, on each shift, should be assigned and prepared to especially place a small amount of free oil in any box showing signs of possible heating, as determined by inspectors placing their bare fingers on the journal at time of inspection, (latter practice governing at all stations). No casual inspection by feeling outside of journal box or any other method except that specially required and instructed for passenger train cars, namely, the raising of lids and feeling of the end of journal with bare fingers will be allowed; if it is done at all, it must be carried out properly, and inspectors disregarding this regulation will be dismissed from the service. If inspectors at these stations do not feel certain of a journal after they have inspected it, they will, if lining, brass, journal and packing are in otherwise apparently good condition, call on the man assigned to apply the necessary free oil and satisfy themselves that this is not overlooked or disregarded. This is very important and should be diligently followed up, good judgment being used.

On cars in a 400 or 500-mile run, the boxes should be oiled probably every other trip at final terminal, although some may need it every trip,

the practice being governed by the nature of the territory through which the train passes. On cars in runs of from 100 to 150 miles (daily), an oiling about once in two weeks at layover terminal should not be exceeded. Free oil alone will not form a remedy for hot boxes. It is, of course, understood that the waste should be in good condition, not allowed to become packed solid, glazed or water-soaked. (The maximum regular assignment of free oil will be made on this basis). Oil will be placed alongside of journal full length toward rear end of train on rising side, so that it may be carried in the direction of normal movement.

The aim of good lubrication is the reduction of friction to a minimum.

Hot boxes are always caused by excessive friction. Friction is the most extravagant method of generating heat, so that a much greater per centage of the locomotive's power is expended in pulling the car on which there is a hot box than would have been necessary had the journal run cool. It is impossible to compute, with any degree of accuracy, the total cost of one hot box to the railroad company, but when one considers the delay to the train, the loss of revenue if a car has to be set out, the extra labor and loss of material through the damage or destruction of journal, brass, oil and waste, it is very large.

Excessive friction is caused by two conditions only, either defective lubrication or excessive bearing pressure.

Defective lubrication may be caused in one case by an inferior lubricant, and in another case by insufficient lubrication, or not enough oil getting to the journal.

This insufficient lubrication may be caused by four separate conditions, which are, that either the waste is not up against the journal, or by the use of waste with not sufficient capillary power, (which is the power that delivers the oil from the bottom of the box to the journal), or by the waste being charred or covered with sand and grit, or by the oil having been washed out of the back of the box by water or melting snow.

The waste not being against the journal is due to there not being enough waste in the box or the lack of proper resiliency in the waste, or the waste being weighted down by foreign substance on top of it. Water in the waste will cause it to lose its resiliency—the power to spring back.

The insufficient capillary power in the waste may be caused by the waste not being thoroughly saturated with oil, or it may be due to the oil being frozen, or to the waste being made of too short strands, threads or fibres.

Excessive bearing pressure is caused by insufficient bearing area, or an inferior bearing metal. Insufficient bearing area is caused by the journal being too small or the bearing metal being raised off the journal by the presence of foreign abrasive or cutting particles (often a short strand of waste), or the bearing being out of alignment, as in the case of the truck sides being out of square with the axles. This relieves part of the bearing from carrying its proportion of the load and puts the whole load on that part of the journal that is actually in contact, which is less than the total

bearing area designed for the journal. All unequally worn brasses removed are evidence of this.

An inferior bearing metal contains hard spots, which alone bear when the soft metal is worn, thus letting the hard spots carry all the load.

Insufficient bearing area may also be caused by the bearing being too tight on the sides or ends, thus relieving the crown of the load it should carry and causing a "pinching" of the journal; or the bearing may be too loose on the sides, causing a concentrating of the load on a small part of the crown that the sides should help to carry. The bearing or journal being warped or rough causes only the high spots to actually carry the load, while the parts that are not in contact perform no service.

Sub-Para. (IV) DRAFT GEAR

Inspection of draft gear is covered by para. 4, sub-para. (iii). On passenger trains many couplers are attached to yokes by means of tail pins, and these pins are provided (in most cases) with a safety strap under them so that inspectors may observe the condition of tailpin in case of break-in-twos.

Sub-Para. (VI) SIDE BEARINGS

The clearances laid down for Shops and Coach yards to adjust side bearings to is a full $\frac{1}{8}$ " for cars with solid side bearings, and not exceeding $\frac{1}{8}$ " on cars with roller bearings—this clearance being for each of the four bearings.

Bearings are not to be oiled, but should be greased every 60 days, or at shopping.

Inspectors will report any excessive side bearing clearances, and if very pronounced will hold up the car and rectify the trouble.

Sub-Para. (V) CENTER PLATES

These are to be inspected to see they are not broken, are properly secured in place, and not binding.

Sub-Para. (VII) DOOR LOCK DEVICES

Side door, end door and creep door lock devices on mail and mail apartment cars must be in good order to prevent unauthorized persons entering cars. When these cars lay over any length of time they should be carefully looked over, and any required work done to put them in good order.

Sub-Para. (VIII) TRUCKS

Pedestals, truck frame and elliptic springs are to be carefully looked over by inspectors, as any failure in these parts would be of serious consequence.

Sub-Para. (IX) FOUNDATION BRAKE RIGGING

The requirements for Foundation Brake Rigging are described under Brakes (para. 11), and notes for inspection are given in para. 4, sub-para. 8. These must be followed carefully by inspectors when looking over passenger trains.

Sub-Para. (X) OVERLOADED CARS

Baggage, mail and express cars are subject to considerable overload at times due to improper distribution of loading, etc. This can be developed through the presence of overheated journals, broken equalizers due to springs going solid, etc. It is desirable that inspectors observe and maintain that all cars passed for main line movement have not less than 1½" free distance between bands of elliptic springs when loaded, otherwise difficulty in service is almost bound to obtain, especially where track conditions are not of the best.

Sub-Para. (XI) FREIGHT CARS IN PASSENGER TRAINS

No Car equipped with freight or short wheel base (less than 6' center to center of wheels) truck is to be allowed to proceed in limited trains; neither shall any car failing to be equipped with buffers be allowed in Coast Line, Transcontinental, or fast trains, (such as Nos. 1 and 4, 5 and 6) between Chicago and Minneapolis. Cars equipped with freight car trucks fitted with elliptic springs and suitable wheels, draft gear and side bearings, proper brake, signal and steam heat equipment, will be allowed to operate on local trains only limited to 30 miles per hour maximum speed.

Sub-Para. (XII) WOODEN CARS AHEAD OF STEEL EQUIPMENT

Passenger cars of wooden construction when free of passengers, messengers, trainmen or other persons, may operate between steel cars as found convenient. Where passengers or employes have to ride in such cars, the steel equipment will be placed at the head end of the train and the wooden cars at the rear, arranged to best suit operating conditions.

Should this rule be neglected or changed by any Operating or Traffic Offices, Inspectors should take the matter up with their immediate superior and handle in writing as a matter of record, for in case of accident this evidence will be required. The way to do this is to first inform the person or persons riding the wooden equipment, and then record this fact and position of car in train on both copies of 975 report, and on own copy note name of official responsible for car proceeding in this manner.

Sub-Para. (XIII) ELECTRIC SIGN ON REAR OF TRAINS

Certain of our principal trains carry an electric sign designating the name of the train. When the rear car is cut off, or another car added to the rear of train, this sign is to be moved and properly fixed to the then rear car. Train crews sometimes request Inspectors to leave this off, or even remove it immediately prior to arrival at depot, and place it inside of car, in order to save delay in getting the train started again. The sign must invariably be located and placed in correct position before train proceeds, as its absence is commented upon by travellers and creates a poor impression, while the time required to fix it in place is too brief to have any bearing on keeping a train on time.

**Sub-Para. (XIV) DELAY IN DYNAMO BAGGAGE
CARS GOING TO COACH YARDS**

It must be borne in mind that the time required in which to prepare a dynamo baggage car for service is much greater than in the case of an ordinary car. The dynamo has to be attended to, and it is on the greatest importance that dynamo cars be sent to Coach yards at the earliest possible moment. Inspectors will do everything in their power to get cars switched without delay, where necessary taking the matter up with the Yardmaster and Superintendent. If action cannot be obtained the matter will be reported to the Master Car Builder, in order that steps may be taken to have the condition corrected.

The inspection of cars in the manner described above should, normally, meet all the demands made upon Inspectors, but other matters will arise from time to time which will demand the display of initiative in order that trains may run on time and be kept in proper condition. To enable Inspectors to meet such emergencies the following information respecting Lighting systems and Heating systems will be found helpful.

Sub-Para. (XV) ELECTRIC LIGHTING ON TRAINS

There are three systems in use for lighting trains by electricity. The most common is by means of a dynamo located in a baggage car at the head end of the train. This dynamo is operated by steam supplied from the locomotive, and when the engine is cut off current is supplied to the train from storage. The next system is by a small dynamo attached to the locomotive. In this case when the locomotive leaves the train the lights are cut off, and it is necessary to have a certain number of oil lamps lighted throughout the train.

The third method is by means of an axle driven generator located underneath the car, which, if powerful enough, can light up the next car attached—These generators have a storage system, which provides current automatically when the train is stationary. Current is conveyed from these various generating systems to the electric light globes by means of a cable carried along the roof of each car, and connected between car and car by the usual connector cable. It is important that these connectors be carefully handled, kept in good order, guarded against mishandling, and properly and securely put up.

Inside of each car are placed ordinary fuses for guarding against any overcharge of current that might result from any one of several possible causes. In the event of an excessive production of current, the fuse will blow out, breaking the circuit, and preventing the possibility of overheating or melting of the wires. Switches for turning lights on and off are also provided.

The principal troubles likely to arise would be the blowing out of a fuse, or a switch becoming defective, and these can be readily rectified by an inspector with an elementary knowledge of ordinary lighting fixtures. If, however, the trouble is in any of the wiring it must not be tampered with excepting by a qualified man.

The belt of an axle generator may become disconnected, in which case it can be replaced as follows: Loosen the belt tension spring and push the dynamo as far toward the axle as possible, then lock it there. Now pass the belt around the two pulleys and stretch it up tight, mark, and cut it square. Place the crescent belt fasteners on one end, lay it on the dynamo pulley and drive the split copper rivets through fastener and belt. Now bring the ends of belt together and drive through rivets. Set the split rivets so that they will split lengthwise of the belt. After belt is riveted, allow dynamo to swing back and tighten spring until belt cannot be slipped by hand. If pulleys show that belt has been running to one side, adjust the dynamo so as to cause belt to run in the center of the pulleys. This can be done by the set screws or some other arrangement for moving one end of the dynamo forward or backward as required. After adjustment is made the car should, if possible, be moved back and forth, say about 100 ft. so as to see that the belt runs centrally with the pulley. This is very important. The supply of belts, crescent belt clamps and rivets, will be found in the car locker.

Storage battery doors must be properly secured, and body hung dynamos quite tight in position, with pulleys properly lined up on axles. It should be observed whether generator belts interfere or cut truck members or brake beams.

Copy of "Instructions to Dynamo Operators" is obtainable upon application through the correct channels.

Sub-Para. (XVI) HEATING OF TRAINS

There are two methods of heating cars—by coal stoves or steam heat. The former requires no explanation, beyond saying that inspectors must see that coal box is filled, ashes removed, and all waste paper and combustible matter removed from around coal box, but the latter is comprised of no less than six different systems on our road. However, these systems have much in common, and can be placed one behind the other in a train without interfering with each others operation.

The systems are:

1. Safety Car Heating Co. (Combination System). Part of Vapor Co.
2. Chicago Car Heating Co. Now Known as the Vapor System.
3. Gold Car Heating & Lighting Co.
4. Standard Heat and Ventilation Co. Part of Vapor Co.
5. Baker Heater, or Hot Water Circulating System.
6. Direct or Straight System.

Each car has a steam pipe running its entire length, equipped at each end with hose and couplings to provide a continuous steam line throughout the train. This steam line is provided with branch connections to the heating pipes in each car. Inside the car are suitable inlet or cut-out valves to control admission of steam to heating pipes.

Each car is provided with one, or more, automatic steam trap, or vapor regulator. Steam traps allow condensation from the heating pipes to escape, and these are used in connection with pressure systems. Vapor regulators

maintain atmospheric pressure of steam in the heating pipes, and are used in connection with the vapor system.

Steam hoses will be coupled up on Coast Line and Transcontinental trains all the year around. Other trains will have steam hoses uncoupled between May 1st and September 1st, unless required coupled by weather conditions.

To operate these various heating systems (excepting Baker) signal the engineer for steam, open rear cock of steam hose, and when a good blow of steam has come through, close it so it remains with just a little steam escaping. Steam can then be turned into the heater pipes but when a train is cold, *this must be done very slowly* to prevent fittings from cracking or bursting.

The two rules to be remembered in regard to steam heat are—(1) *Always keep a little steam escaping at rear of train, and* (2) *Never cut off steam from train line without first opening rear steam pipe valve wide and blowing out steam pipe line.*

There is no connection whatever between the heating pipes of the vapor system and the water circulating pipes of the Baker heater, excepting the proximity of the two systems, both inside and outside the car, at the Baker heater cross-overs, while a spur from the train line keeps the Baker pipes from freezing when the heater is without fire, and a branch line from the train line is run up around the expansion drums of the heater to prevent them from freezing when not in use.

Fire and steam may be used at the same time, except that when a fire has been in the heater for some time, and the water circulation pipes are very hot, the vapor system should not be turned on until the fire is low and the water is cooled.

The Baker heating system includes radiating pipes, expansion drums having funnel filling cocks, and safety valves attached; also a stove. The radiating pipes pass through the stove in the form of coils and are connected to the expansion drums. The system is provided with drain cocks. The radiating pipes, which are located along the side of the car and beneath the seats, are filled with water, its highest lever being half-way up in the expansion drums, which are located on the roof of the car.

The principle of operation is simply "Circulation" of water induced by fire in the stove imparting heat to the water, forming steam globules which always have a tendency to rise, and in so doing cause the heated water to travel upward into the expansion drums, and then down and through the radiating pipes, the cooled water returning into the bottom of the stove for reheating, thus warming the car.

Any car containing a Baker heater located back of eleventh car in a train failing to warm satisfactorily, may have a fire maintained in same.

To start a brisk fire in a Baker heater stove may cause it to immediately generate steam pressure and blow off at the safety valve; therefore, when

first starting a fire, leave inside slide and ash pan door open and upper outside slide door closed as much as possible, feeding furnace with kindling wood and soft coal, followed up with hard coal. After getting a good fire started with hard coal, the inside slide lid should be closed and ash pan slide door adjusted according to requirements. The inside slide must not be left open when running, as the smoke pipe will become overheated and thus damage the car.

Inspectors will see that coal box is filled, fire laid in heater, ashes removed from ash pit, also all waste, paper and other combustible matter removed from around coal box or heater room.

All inspection points should have on hand fifty feet of $\frac{1}{2}$ " rubber hose, equipped with standard steam hose coupling at one end, and about 24" of iron pipe with pointed outlet at the opposite end, so as to be in a position to thaw out drains, drips, tanks, etc., as required. This is light and can be easily manipulated by one man, whereas heavier hose such as $1\frac{1}{2}$ " or 2" is unwieldly and awkward. All steam hose must be properly coupled and tight to avoid leakage. A supply of proper gaskets should be kept within easy reach at all times. Steam hose must be carefully examined to be sure that it is in fit condition to give satisfactory service. This is particularly true on the head end of long trains, as the older hose can be relegated back to non-important trains and rear cars. When not in use, steam hose should be hung up out of the way by dummy coupler or hook.

Inspection should be made to see that cloth around steam pipe covering beneath cars is not torn and hanging down. As soon as it shows signs of getting into this condition the fact must be reported so that it can be repaired and painted with asphaltum, to present a neat appearance and avoid possibility of fire.

In applying gaskets to steam hose see that they are properly locked to prevent loss when blowing out steam.

Inspectors will occasionally look over the interior of cars to see that inside piping is well strapped, in order to prevent pocketing of condensation and rattling when a car is running. Where steam pipe leaks enroute, emergency repairs can often be made by wrapping the failed portion with a piece of rubber hose securely wired in place, followed with three or four courses of electrician's friction tape, then powdered asbestos, completed with a muslin outer cover.

Full details of Car Heating are contained in "Heating of Cars—110-1," copies of which may be obtained upon application through the correct channels.

Para. 15. INTERCHANGE OF PASSENGER CARS

No passenger car from connecting lines is to be allowed to proceed in any train on this railroad without first being passed upon by a car inspector, or other authorized representative of the Car Department. Many cases of failure have obtained in connection with foreign passenger equipment, due principally to improper condition of journal boxes and contained parts, draft gear and attachments, and bad wheels. The brake equipment must be closely scrutinized and known to be in proper working order. It should be established that the equipment is not overloaded, that side bearings, trucks, *wheels*, springs, equalizers, etc., are all in safe condition to run. If it is necessary to hold cars over for another train to put them in condition, it should be done. Under no circumstances run any risk of accident. At the same time in no case will a delay be countenanced due to lack of effort on the part of this department. It has been a very difficult matter to obtain the necessary authority to stop the practice of placing foreign passenger cars in our trains before we have had time to pass on them, and now this has been granted a train must only be held for necessary inspection and work, which is to be done in the quickest possible time.

In the past we have experienced considerable trouble with through express cars received from Eastern lines for delivery on the Pacific Coast. These cars have been received closed and sealed with the radiator shut-off-valves under the car closed, and the cut-out valves beneath the car left open. These cut-out valves are on the steam branch line, and as a result of being left open, a gradual seepage of water into the radiators occurs, and in cold weather this freezes, resulting in heavy damage from burst and frozen radiators. As the cars go west we have to put them under steam, and serious delays occur on account of having to rectify the above troubles.

Inspectors at receiving points will therefore see to two things—viz. (1) *that the cut-out valve beneath the cars is closed*, and (2) *that the radiator inlet valve is wide open*, for which purpose the car will be opened if necessary.

Foreign cars are sometimes received with non-standard steam couplings, or hose of light construction that will not stand the steam pressure necessary in our trains. Such hose must be replaced with our own standard, the old hose being turned in to the Foreman with proper record of car number and initial from which removed, train number and date. When car is returned to owners hose will be returned with it, and we will retain our own.

Specially made up hose of short length and properly stencilled are supplied all gateway stations and terminals where foreign cars come to us, in order to avoid one of our long hose being applied in substituting foreign lines design, which is usually of shorter length. Unless this is done couplings are liable to drag and be ripped off by crossovers, crossing planks, etc.

Cars received in interchange on our road for delivery to the Northern Pacific must be equipped with rolled steel, steel tired, or Davis cast steel wheels.—Cast iron will not be accepted by the N. P.

Section II

REPAIRS

Para. 1 **GENERAL METHOD OF REPAIRING CARS**

Upon our ability to repair cars effectively, economically and efficiently depends in a large measure our success as a department. The desired results can only be obtained by careful planning, proper preparation, and thorough execution.

With this end in view schedules for all classes of freight car work of which any appreciable quantity has to be handled are prepared in readiness for carrying into effect as soon as conditions will permit. It is a matter of considerable regret from a purely mechanical point of view that most of the heavy car work has to be carried out during periods when the heaviest demands are being made upon equipment. Work could be carried out much more advantageously and economically during so called "slack" periods, but conditions over which we have no control govern the situation, with the result that we must handle our heaviest work during busy periods. Realization of this fact, and preparation accordingly, will help greatly to mitigate its disadvantages from our point of view.

Experience is a great teacher, and the constant study of our work enables us to ever improve upon our plans. Accordingly Schedules are altered from time to time, but it is highly desirable that we retain uniformity so as to guard against the evils that result from the existence of a varied series of cars. In order to obtain the advantages of our experience, and at the same time avoid the variations referred to, meetings will be held prior to the launching of any programme, attended by those who have to carry out the programme, at which all details will be discussed and if possible illustrated.

The work involved by a programme will be assigned to points at which it can be carried out to best advantage, taking into consideration the regions in which cars are required for loading, as well as our facilities, available material and forces. As far as possible work will be assigned to the fewest number of points—that is to say, Schedule 5 work will be done by say three or four points only, Schedule 32 by two points only, etc. By this means the handling of material is greatly simplified, fewer blue prints and reports are necessary, and considerably less administration is involved, while experience on one class of work develops an organization in such a way that greater output can be obtained.

The preparation includes obtaining in advance the necessary tools and material, putting facilities into good shape, getting ready track or shop space, studying blue prints, and planning the distribution and assignment of work.

In ordering tools and material two things must be borne in mind, viz: time and definitiveness. Requisitions should be made out 60 days in advance whenever possible, include all items required for programme, state clearly what work it is wanted for, and by what date delivery is necessary. Requisi-

tions for material for a certain Schedule or Programme should be kept quite separate from requests for other material, and must not include inflated quantities. It must not be presumed small items such as cotters, bolts, nuts, screws, etc., can be drawn from ordinary stock, but every article included, right down to the last washer. Failure to appreciate what is involved in providing material has hampered operations very much in the past, and all concerned should realize their responsibility in this direction. If necessary copy of original bill of material should be requested, and study of requirements made, as unless the Foreman responsible for carrying out a repair programme can establish what he requires, it is unlikely anyone else can.

Studying blue prints need not be confined to looking them over in an office. A car of the class to be handled should be set in at a convenient location, and study made at the car, or, better still, if the work is being done at another repair point, or there is a sample car available, study should be made of the completed car.

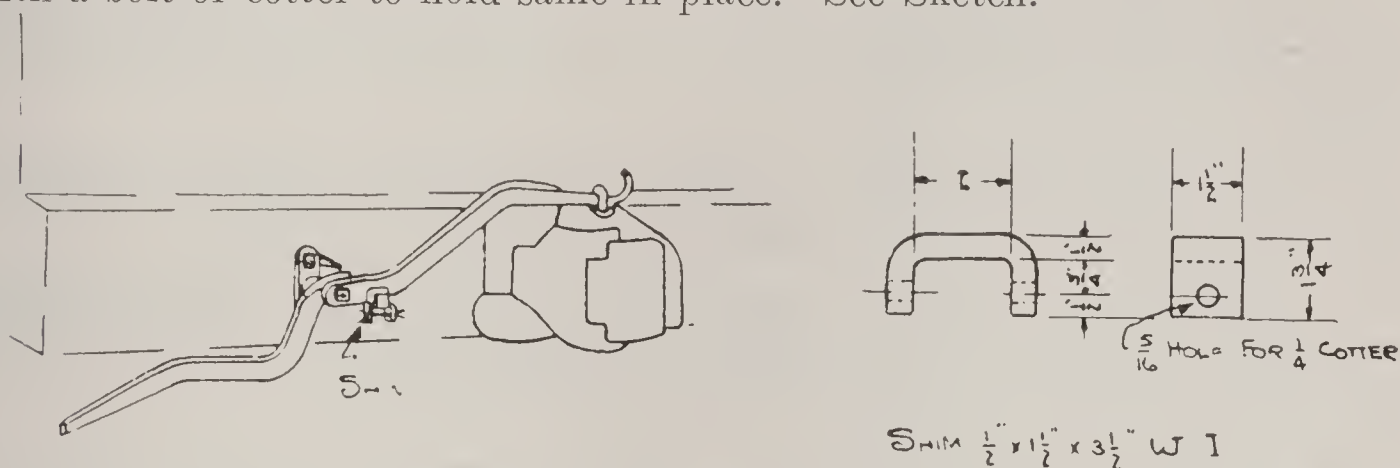
Proper execution of the work will depend upon supervision—presuming preparation as outlined has been made. The individual carman is only as a cog in a wheel, and cannot be expected to give service until the wheel starts turning. At the outset of new work all is more or less confusion to him, but once cars reach a stage of completion his mind clears and he can perform his work more pleasantly and intelligently. Foremen should realize that the weeks of thought given a programme, ordering of material, and studying of prints are unknown quantities to the carman, and for that reason supervisory forces must be able to explain what is required at the commencement of new work. That this is not done is evidenced by a study of output at various points. Some places spend weeks before getting organized, and to a large extent matters straighten themselves out. At others within a few days work is on a smooth running basis. This third angle to the effective repairing of cars—supervision, or rather organization and supervision—is the side of which the responsibility rests most directly on the shoulders of Foremen. Study of the problem, the reading of books and current literature on the subject, personal communication with other Foremen, organizations and industries, as well as visiting plants at every opportunity, are some of the means which may be employed by those who wish to learn how to grapple with their problems, and to advance unless the highway of success.

The following excerpt from the opening address of our 1921 Staff Meeting is worthy of a place in the memory of all supervisors:

“Probably no single question has caused so much concern to those who are responsible for shop output as the problem of handling men, and it will continue to confront us for some time to come. The day of the boss, the driver, is gone, and to attain any degree of success in this direction under present conditions, you men must be leaders who can appeal to the men under you through a study of the motives that stir them to action. If we could but have this thought firmly fixed in our minds, we ought to go back to our work determined to make it a success in spite of questions relating to facilities or materials, knowing that the greatest potential value rests in our handling men—to see that justice is given them as well as the Company.”

The following kinks for carmen are published for information:

A good many Carmer levers (push down type), have handles closer than 18" to rail, which is a Safety Appliance defect, and is ordinarily corrected by removing lever, heating same and bending up. This is an expensive operation, and the desired results can be obtained by placing a shim over the right end of push down lever, which raises the handle 7 times the thickness of shim. Shim should be shaped as shown and $1\frac{1}{2}" \times 2" \times 1\frac{1}{2}"$ with a bolt or cotter to hold same in place. See Sketch.



NOTE

1 SHIM AS SHOWN WILL ELEVATE HANDLE $3\frac{1}{2}"$

Cars under load and heavy on side bearings, equally divided, can be raised without releasing load by jacking up off the trucks and placing washers of a sufficient thickness in the bottom center plate.

Box cars with ends bulged out can often be straightened without the necessity of removing end posts by means of a substantial chain, fastened to highest and lowest point of end post, chain drawn to correct length, and a jack inserted. As the strain is imposed upon the chain and the end post, the latter will bend, and jacking should be continued until post is upright.

Cars with doors closed and scuffed and punctured by the use of bars to close them indicates that the door is in a bad condition and should be fixed.

Single, double or triple loads of piling, spars, or timbers which may have shifted on bunks indicates that bunk is improperly secured and braced, or that the drawbars have not been blocked as required and all slack taken out. It is a good policy when so found when there is a wye in yard to turn the load and it will equalize itself as the load shifts the way that it travels.

Before transferring a load from a bad order car, it should be established that repairs cannot be made satisfactorily under load. Remember that the transferring of a load paves the way for a freight claim, and whenever possible cars should be repaired under load, even at the expense of slight delay.

Box cars with concealed loads that have ends bulged, or with car sagging or leaning to one side, should not be allowed to leave repair tracks without opening car to ascertain cause.

In splicing a draft timber of a wooden underframe car loaded with grain, a box with top off, turned upside down, can be placed on floor of car by tunnelling through load. By so placing box, car can be repaired under load without spilling any of the grain.

When repairing refrigerator cars, and it is observed paint or shellac has turned black, it is an almost sure sign the woodwork has rotted.

Before hopper cars leave repair tracks, see that doors are properly closed. Where provided with chain shaft, pry down on door with pinch bar, and if chain is not properly wound up it will be discovered by door opening part-way.

Light repair cars should be placed on specially designated tracks so that they may be promptly repaired and returned to service.

The switching of repair tracks during working hours must be avoided, but when this cannot be done men are to be kept engaged as far from where switching obtains as possible, so as to avoid loss of time.

Cases are occasionally called to attention where repair track locks are used by other departments. These locks are for one specially designated purpose, and should any instance be known where they are being put to other use, the matter is to be reported at once through the correct channels, so that it may be rectified.

Para. 2 FREIGHT CAR REPAIRS (SYSTEM)

Sub-para. (I) CLASSIFICATION OF WORK

Schedules cover the heavier work on system cars, and all details are given under the individual schedules. The cars they apply to are as follows:

Schedule	Class of Car	Capacity	Series	Principal Work Involved
1	Box (Wood)	60 M	51900 to 68198 68300 to 69524 70526 to 72524	Discontinued.
1 A	Box (Wood)	60 M	Same as Above	Steel channel center sill with cover plate: New body bolsters: Channel end sill: Steel striking castings: Friction draft gear: Roof braces: Brake beam safety hangers: Side & end sheathing straps: Inside end plate brace: End belt rail band.
2	Box (Steel Center Sill)	60 M	68200 to 68298 69526 to 70524	Cover plates for channel center sills: Flanged center sill patches: Channel end sill: Steel striking castings: Friction draft gear: Roof braces: Brake beam safety hangers: Side & end sheathing straps: Inside end plate brace: End belt rail band.

Schedule	Class of Car	Capacity	Series	Principal Work Involved
3	Box (Steel Center Sill)	80 M	72526 to 79994 80000 to 81478	New steel center sills with cover plates and body bolsters: Friction draft gear: End sill channels: Steel striking castings: Side sheathing straps: Roof braces: Inside end plate braces: End belt rail band: Brake beam safety hangers. OR Cast steel draft arms to be rivetted to present steel center sill channels: Bottom cover plate to be applied to present center sill channels, extending from body bolster to body bolster: Top cover plate to be applied to present center sill channels, extending from end sill to back of body bolster: Friction draft gear: End sill channels: Steel striking casting: Side sheathing straps: Roof braces: Inside end plate braces: End belt rail band: Brake beam safety hangers.
4	Box (Steel Underframe)	80 M	87484 to 93480 500000 to 506204	Side and end sheathing straps: Lower belt rail bands: Heavier corner bands on upper belt rail: I beam end post reinforcing casting: Inside end plate braces: Roof braces: New standard door fixtures (where renewal necessary): Steel striking castings: Brake beam safety bars.
4 A	Box (Steel Underframe)	80 M	81482 to 83480	
5	Box (Steel Underframe)	80 M	83482 to 87480 200000 to 206500	Butterfly ends: Steel striking castings: Class B patches: Roof braces: Inside end plate braces: Side & end sheathing straps: Lower belt rail band: Heavier corner bands on upper belt rail: New standard door fixtures: Brake beam safety bars: I beam end post reinforcing casting.
7	Box (Steel Frame)	100 M	700000 to 103999	Roof braces.
9	Box (Steel Center Sill)	80 M	506205 to 507204 507205 to 508204	Side sheathing straps: Roof braces.
10	Auto (Steel Underframe)	80 M	590000 to 590249	Roof braces: Side & end sheathing straps: Lower belt rail band: Heavier corner bands on upper belt rail: Inside end plate braces: Brake beam safety bars.

Schedule	Class of Car	Capacity	Series	Principal Work Involved
16	Auto Carriage (Steel Underframe)	80 M	206501 to 207407	Roof braces: Inside end plate braces: Side & end sheathing straps: I beam end post reinforcing casting: Lower belt rail band: Heavier corner bands on upper belt rail: Large end doors to be removed, and end of car reconstructed to be same as opposite end: Steel striking castings: Brake beam safety bars.
18	Furn. (Steel Center Sill)	60 M	24700 to 25686	(Contemplated) Cast steel draft arms to be rivetted to present steel center sill channels: Bottom cover plate to be applied to present center sill channels, extending from body bolster to body bolster: Top cover plate to be applied to present center sill channels, extending from end sill to back of body bolster: Friction draft gear: End sill channels: Steel striking castings: Side sheathing straps: Roof braces: Inside end plate braces: End belt rail band: Brake beam safety hangers.
19	Package (Steel Center Sill)	80 M	96000 to 96058	Brake beam safety bars (no other improvements needed).
22	Refr. (Steel Underframe)	80 M	400000 to 400499 735 to 2999	(Contemplated) Changes in underframe, superstructure and ice bunkers.
23	Stock (Wood)	60 M	8267 to 10099 10201 to 12999	No programme yet arranged for.
24	Stock (Steel Underframe)	60 M	100000 to 102499	Not definitely decided. Contemplated applying Butterfly ends: Steel striking castings: New design trucks.
27	Flat (Wood)	80 M	45551 to 45699 45701 to 45999 68001 to 68499 TE506 to TE877 32101 to 32147	No programme yet arranged for.
28	Flat (Steel)	100 M	60691 to 61999 62101 to 62699	Brake beam safety bars (No other improvements needed).
29	Coal (Steel Center Sill)	100 M	32259 to 37257	End gate hooks: Stakes to be extended over cross ties to prevent sides spreading: Brake beam safety bars.
31	Coal (Steel Center Sill)	100 M	29677 to 32075	End gate hooks: Stakes to be extended over cross ties to prevent sides spreading:

Schedule	Class of Car	Capacity	Series	Principal Work Involved
				Brake beam safety bars: Cast steel draft arms to be applied to present channel center sills: Steel striking castings: End sill channels: Cover plates on channel center sill.
32	Coal (Steel Underframe)	100 M	300000 to 302499	Butterfly ends: End gate hooks: Inside gussets: Plate side stakes: Knee castings for side stakes: Side bracing: Steel striking castings: Brake beam safety bars: Re-arrange hopper doors, equipping same with Wine type door hooks.
33	Hopper (Steel)	100 M	57801 to 57835	Brake beam safety bars—otherwise repair in kind.
34	Ore (Wood)	100 M	25493 to 25891	Bradford draft arms: Bradford draft gear: Special type couplers (material now on hand). End sill channels.
35	Ore (Wood)	100 M	50001 to 53799	Extend side planks to full length of car: Heavier side stakes: Supports for floor beams.
39	Ballast (Wood)	80 M	48101 to 48969 48971 to 49999 70001 to 70969	Not definitely decided.
40	Ballast (Steel Underframe)	100 M	70971 to 72969	Brake beam safety bars: Reinforce body bolster construction.
41	Caboose (Steel Underframe)	40 M	ALL	Re-arrange interior to meet standard requirements: Brake beams to be inside hung: Brake beam safety bars.
42	Caboose (Wood)	40 M	ALL	Re-arrange interior to meet standard requirements: Brake beams to be inside hung: Brake beam safety bars: Center sills (when requiring renewal) to be extended through to platform end sill.

It will be clearly understood that the only work authorized under schedules is that covered by current instructions.

In addition to these schedules it will at times be necessary to make repairs to system cars, under one or the other of the following classifications:

Class	Name	Labor and Material covered by classification
A	Very Heavy	100 or more hours direct labor at car.
B	Heavy	60 or more hours direct labor at car.
C	Medium	20 or more hours direct labor at car.
D	Light	One hour or more direct labor at car.
E	Running	Less than one hour direct labor at car.

Bad order cars must not be shipped from one repair point to another, excepting by direct authority of the District General Car Foreman. When bad order cars are to be sent from a point in one district to a point in another, it must only be done with the written authority of the M. C. B.—or A. M. C. B. in the case of movement from one General Foreman's territory to another on Lines West.

The practice of billing bad order cars to shop points has resulted in severe and expensive congestion, and in addition to noting themselves, Foremen must warn all agents that the practice is positively forbidden. The matter must be handled as outlined above.

Sub-para. (II)

SYSTEM BOX CARS

When box cars come on to repair tracks, door tracks and rollers should be greased, and it should be assured that each door works freely and easily.

Side door stops of 3"x5" fir are to be used extending roof to side sill, in accordance with blue print issued with M E Circular Letter 1003.

Right hand door posts found rotted or broken off at the bottom, but in good condition above the sill, can be reclaimed by the use of an oak piece being set into the post and reinforced with a metal plate. This is shown in blue print issued with M E Circular Letter 1031. In making this application a new type door bracket, shown on same print, can be applied to advantage.

F.66 Camel door locks can be applied in connection with the new door lock slate, as shown in blue print issued with M E Circular Letter 1015, which plate is to be put on all box cars as they pass over repair tracks.

Many of the brake cylinders and reservoirs under the 42 foot 80,000 lbs. capacity box cars equipped with Bettendorf underframes are indicating signs of working, no doubt due to the overhanging type of support used, and as cars equipped with this type of support pass over repair tracks, end brackets or braces should be applied in the manner shown on print accompanying M E Circular Letter 1021.

Cars in Series 500,000 require close attention to metal roofs and ends. These are often found badly rusted, and scale must be removed, and both roof and ends painted. Also roof clips are to be given necessary attention. As these cars go over repair tracks they are to have the brake staff casting originally secured to end plate and roof changed, and a brake staff step applied to end of car, as shown in blue print D.336 issued with M E Circular Letter 1017.

Cars in Series 700,000 (formerly stencilled "GET") are to carry the new number now on outside of car on the inside as well. When cars go over repair tracks interior number will be noted, and when found to differ from exterior number will be changed.

The doors of these cars can be made to operate much more freely if a 1/8" shim is placed back of the bottom door rail, as shown in blue print accompanying M E Circular 1012.

When these cars are in need of heavy repairs necessitating rebuilding, as in the case of wrecked cars, the limit of expenditure must not exceed \$1,500.00. For heavy repairs, estimates must be prepared and submitted to M. C. B. for approval before work is begun.

Sub-para. (III) SYSTEM GONDOLAS

As cars in *series 32,259–32,257* go over repair tracks, top and bottom center plates are to be checked up to ascertain just what clearance is provided. If less than 3/16" is shown, center bearing casting will have to be changed.

Gondolas in this series are also to have the hopper operating device changed in accordance with Style No. 2, shown on blue print accompanying M E Circular Letter 1023.

Cars in *series 300,000–302,499* are to have device changed in accordance with Style No. 1 shown on same blue print.

Sub-para. (IV) SYSTEM STOCK CARS

The slats on all stock cars must be maintained at the correct spacing shown on the blue prints for each class of car. When repairs have been made in some instances this spacing has been altered and made altogether too close, making proper ventilation impossible, and not permitting of the showering of hogs, which is very necessary in hot weather. This is to be rectified when cars are found as described.

When water troughs are removed from cars, piping and fixtures must be removed also, in order to prevent possibility of injury to horses or other stock when being shipped.

Letter boards on stock cars are to be 12" wide, and applied in accordance with M E Circular Letter 1028, but it is not necessary to use one 12" board—two 6" may be used.

Fir timber when used for stock side door posts rots very quickly, and only oak is to be used for this purpose.

When posts and braces are found rotted or deteriorated at lower extremities, considerable timber can be saved by lap splicing as shown in blue print accompanying M E Circular Letter 1004. When cars leave repair tracks posts and braces must be in proper position, and cars not allowed to go into service with braces, etc., out of castings at bottom.

Double deck cars must have upper deck properly supported. Details of the method of application showing proper supports, are given in blue prints 7930C and 7817C, copies of which are obtainable upon application.

Sub-para. (V) SYSTEM REFRIGERATORS

Refrigerator cars must be equipped with hooks and fasteners to keep doors in an open position. Without these fixtures they will not be accepted in interchange.

Sub-para. (VI) SYSTEM ORE CARS

As far as possible ore cars will be repaired under the programme provided

by Schedule work for this class of equipment. The work will be carried out at points designated at time programme is authorized.

Repairs other than under programme will, normally, be carried out on the Superior Division during the winter months, so that cars may be available for service during the ore season. Specific details of the work to be done cannot be given, but foremen at points where ore cars are handled will keep themselves posted as to what the Schedule work for these cars involves, and will avoid heavy repairs as far as possible, allowing the cars to run until such time as Schedule work is authorized. However, demands made by the business offered will govern the situation to a large extent, and repair forces will be arranged accordingly.

In repairing ore cars, consideration must be given to work to be done when care car is shopped for schedule repairs, so that money will not be spent unnecessarily in applying parts that will later be removed and rejected.

While cars are on repair tracks the trucks, wheels and journals must be carefully looked over, and any work necessary carried out to put them in first class shape. It is of the greatest importance that when cars leave repair tracks the trucks are in good condition, as with the heavy weights conveyed in these cars, and the conditions under which they are operated, great strain is imposed upon trucks and wheels.

Air brakes are similarly to be given especially careful attention.

Sub-para. (VII) SYSTEM FLAT CARS

Side stake pockets on flat cars in commercial service are to be spaced 24 inches minimum and 42 inches maximum. Bent plate type of stake pocket, secured by either 4 bolts or rivets, and with inside washer bearing plate, will be used.

Flat cars in *series 60,001-61,999* have train line between center sills. This installation makes maintenance difficult account insufficient space to operate a pipe wrench. It has been noticed on some of these cars after floor was removed that hole had been burned through cover plate in order to work on train line. This must not be done under any circumstances. As cars of this series are held for repairs the train line should be placed outside of center sills, only crossing through them, as indicated on sketch accompanying M E Circular Letter 1042.

Sub-para. (VIII) SYSTEM CABOOSSES

When cabooses pass over repair tracks, or enter shops for general overhauling, the air gauge must be tested with an accurate test gauge or dead weight tester, and if found incorrect replaced with an accurate gauge. (Whether cabooses go over repair tracks or into shops or not, these gauges must be tested every six months.) The test can be made by attaching an accurate test gauge to the "T" in the pipe between the cut-out cock and the gauge on the caboose. This "T" is plugged and placed in the pipe for the purpose of testing.

In all cases where stove pipes project through caboose roof, a suitable

cylinder to provide an air space around the stove pipe must be provided, as shown in blue print accompanying M E Circular Letter 1052.

For the better accomodation of train crews in using cooking utensils in preparation of meals, a new drum and top plate has been made for caboose stoves.

This arrangement will fit on the present stoves and hereafter no more of the old type of stoves are to be made, but as new stoves are made, or replacements are necessary to the present design of top, the improved type should be provided, as indicated in blue print D 631 issued with M E Circular Letter 1029.

As they go through shops for general repairs, standard ice boxes under cupola are to be installed in all caboose other than those operating in pool service on the Rocky Mountain and Mississippi Division, and those operating between Othello and Tacoma in through freight or time freight service.

Original blue print shows ice box built in, but instead of building in permanently it is preferred that they be made separately and placed in caboose underneath the cupola, as shown in blue print issued with M E Circular Letter 1002.

In applying this movable ice box, arrange to put in a partition separating the space for ice box from the oil room, and also see that the ice box is cleated in position so as to prevent shifting. Care should also be taken to locate the ice box away from end of caboose in which the stove is located. Inasmuch as all cabooses have ice boxes of various types and locations, the cost of the standard application will be charged to repairs. (Cabooses used in transfer service only are not equipped with ice boxes.)

Most of our cabooses are at present equipped with outside hung brake beams, and it has been found that the cost of maintenance will be reduced considerably and better results obtained by having the brakes hung on the inside, secured to the trucks. Blue print 11686-E issued with M. E. Circular 1076 shows the combination swing hanger bearing and brake hanger bracket to be used, and Blue Print 11699-D shows the application of the bracket and brake beam in position. The print does not show the present standard brake beam hanger which should be the "U" type. On such of the cabooses as were converted from box cars and which have the short wheel base trucks the inside hung brakes cannot be applied, but the change should be made on all other cabooses as they go over repair tracks for general repairs.

Sub-para. (IX) SYSTEM TENDERS

As tenders pass through shop or receive classified repairs, the top end of the drain pipe should be reduced by rolling in a $\frac{1}{4}$ " bushing with $2\frac{1}{2}$ " flue roller, similar to what is shown in style No. 1 arrangement on the sketch referred to below.

When new applications of drain pipes and collars are necessary, the drain pipe should be swedged down from 3" to $2\frac{1}{2}$ " from the upper end,

similar to what is shown in style No. 2 on the sketch accompanying M E Circular Letter 1033.

The purpose of reducing the tender drain pipes on the top is to prevent pieces of coal, cinders and other foreign matter lodging in same and anything that would pass this reduced opening would pass the remainder of the pipe.

Many of our tenders equipped with wood end sills, employ a small cast washer for the eye bolt of the safety chain between the engine and tender, and Federal Inspectors have criticised this arrangement, claiming the small bearing area afforded by the washer, allows the same to be drawn into the wood and length of the chain increased.

In order to avoid such criticism, as tenders so equipped pass through shops washer plate will be applied, as shown in M. E. Circular Letter 1036.

When it is necessary to raise tender frame to standard height on *L3 tenders* (only), arrange to apply a spring cap designed and shown on blue print issued with M. E. Circular Letter 1038. This will eliminate the removing of the body center plate and the application of a liner.

Spring planks for 80 M and 100 M capacity tender trucks will be rolled channel plates, while on the 120 M the flanged section will be used. Blue print accompanying M. E. Circular Letter 1043 will give details of these spring planks.

Body bolsters on the 80 M tender trucks are causing trouble, due in some instances to the bolster not being properly assembled. Investigation has shown several bolts missing, as indicated by the letter "A" on blue print E-620, issued with M. E. Circular Letter 1044, and this must be carefully checked up.

We also found that the bottom plate on some of these bolsters is not long enough to make a snug fit at the end where the top plate meets same, as indicated by letter "B" on above mentioned blue print, and bottom member is allowed to work. Where these conditions exist, the opening between the above mentioned plates should be filled in with a plate and welded at the first opportunity. Bolster should also be strengthened at side bearing by the application of filler, as shown on sketch, the pattern number of which is L-57-2.

By the use of the J. M. air brake cylinder packing cups, air leakage is eliminated to a greater extent and for a longer time than is attained by the ordinary non-expansive packing cup.

This, together with the smaller amount of lubricant required as compared with the ordinary packing cup and further that the heat does not affect them, results in increased brake efficiency, reduction in expenditures for replacement, lubricants and labor costs; increased factor of safety in handling trains, on grades; reduction of expenditure for fuel.

While some tenders are now equipped with the J. M. Cup, for the

purpose of efficiency and economy, it is desired to extend this practice to standard, and all tenders as they pass through shop should be equipped with the J. M. Packing Cup and Expander Ring.

On tenders for A1, B2 and B3 converted locomotives in passenger service, the alterations in manhole and slope sheet shown in blue print A-79, referred to in M. E. Circular Letter 1049, must be made as tenders pass through shops.

On account of numerous derailments it has been decided to change side bearings on trucks of tenders, so that front truck side bearings will be spaced 40" center to center and on rear trucks the side bearings will be spaced 52" center to center except as may hereinafter be noted on account of mechanical difficulties and the original construction of the trucks affected. In principle there will be no variation from the above instructions.

Drawings which apply are listed below and may be obtained upon application :

	Truck	As Built	Revised Arrangement	Details
Jan. 9	60M-Style No. 1	1122-C	C-459	D-765
13	60M-Style No. 2	4383-C	C-461	C-461
17	80M-Swing	18474-C	D-770	D-770
*21	100M-Andrews .	C-326	D-772	D-772
*25	100M-A2-c	11683-C	D-822	D-822
30	120M-L3	C-137	D-826	D-826
Feb. 4	100M-Barber**	11833-E	D-828	D-828
		15315-D	D-837	D-837

*39" spacing on front truck. **50" on rear truck.

It is also necessary to give special attention to side bearing clearance on tenders.

Elliptic spring bands on tenders must have a clearance of at least $1\frac{3}{4}$ " between bands when under static load. This must be provided on all tenders passing through shops.

Sub-para. (X) ALL CLASSES OF SYSTEM FREIGHT CARS

Murphy XLA roofs must be given very careful inspection to prevent the large number of claims resulting from leaky roofs. Sketch issued with M. E. Circular Letter 1024 shows the roof application. To prevent further leakage between lock flange and roof sheets, they will be firmly hammered together. Ridge pole bolts must be inspected and tightened carefully so that tension will not be decreased on account of shrunken ridge pole.

Brake Lever Proportions will be checked to gradually correct the various dimensions other than original which have crept into use on our cars. The correct proportions will be found in the diagram book issued with M. E. Circular Letter 1041, and when checked or corrected car will be stencilled in accordance with blue print D-696 accompanying above mentioned circular letter.

Type D Couplers must be greased at contact points, such as lock block, etc., to overcome difficulty in operating them.

Center plates and side bearings should also be given a little grease when cars are jacked up.

Threshold plates are not desired on system cars, and if receiving A, B or C Class repairs, plates will be removed and reclaimed for useful purposes.

All cars must be stencilled with month and year built, excepting those built prior to 1895. A metal badge giving the information is permitted to be used under the ARA rules. On tank cars body and tank should bear distinctive dates, unless both built at same time.

The splicing of sills of wooden system cars is to be done in accordance with the following: Longitudinal sills may be spliced at both ends, except that not more than two adjacent sills may be spliced at same end of car. The splicing of any sills between cross tie timbers will not be allowed.

The splice may be located either side of the body bolster, but the nearest point of any splice must not be within 12 inches of the same, except center sills, which must be spliced between body bolster and cross tie timber, but not within 26 inches of body bolster.

The splicing of longitudinal sills other than center sills is to be done in accordance with Fig. 9-C on blue print 82318-1; old splices now on cars may be repaired.

Center sills must be spliced in accordance with Fig. 9-B on blue print No. 82318-1 when new splices are used. This blue print provides for a uniform splice for the various classes of cars and must be followed as far as practicable to obtain uniformity and interchangeability of splices. Old splices now on cars may be repaired.

Tie rods and roof rods are to be given proper attention when cars are on repair tracks. When roofs are off tie rods and roof rods are to be secured with nut, which is to be properly rivetted over, to prevent roof coming down due to nut coming off.

Elliptic Springs, when it is necessary to block them, must be so blocked that the springs will be properly supported, and blocks wired so they will not shift out of position.

Draft Gear Carrier Irons must be securely fixed. Missing nuts are to be replaced without fail. When cars go over repair tracks and facilities exist for doing the work, the pan referred to should be rivetted in position. Where the carrier iron is malleable, as Patt. 4651, bolts $\frac{7}{8}$ "x3" should be used, nut drawn up tight and rivetted over.

Barber rollers are to be removed from cars with Bettendorf trucks, *when located between the springs and spring plank*, and wooden blocks inserted in place thereof.

Cardwell Draft Gears, as well as any other draft gear, should have careful inspection when car is on repair track. Much damage to equipment will result unless unnecessary slack is taken up in Cardwell gears. In most cases this can be done by drawing up the rod in the usual way, but if not friction

parts are worn to a point requiring renewal, and should be handled accordingly.

Journal Boxes not repacked within nine months must be repacked in accordance with Standard Practices, and cars so stencilled.

Door Locks will remain a source of constant annoyance and result in operating difficulties, claims, and cars being sent to repair tracks, until such time as every car is properly locked over on respect to this feature while it is in the repair track. Locking mechanism on H. & B. cars should be carefully examined to see that no working parts are defective.

Trucksides, either arch-bar or cast steel, when applied must be properly gauged before being allowed to go into service, to insure correct wheel base. The slightest variation between the distance from journal center to journal center on one side of car, as against the opposite side, will cause endless trouble. All points must have suitable gauge for testing newly applied trucksides.

Para. 3 FREIGHT CAR REPAIRS (FOREIGN)

Sub-para. (I) GENERAL PROCEDURE

Foreign cars will be handled in accordance with the policy pertaining as the result of business conditions at the time at which work has to be done. When our equipment is sufficient in quantity and of the character required to handle the business offering it will be to our advantage to send home all possible foreign cars, even to the extent of forwarding them empty. This will be governed by current instructions. Ordinarily cars will be repaired strictly in accordance with A. R. A. rules, so that we may be properly compensated for labor and material expended. During times of pressure cars will be kept moving as far as is practicable.

Heavy repairs to foreign cars, the total cost of which will exceed \$200.00 should not be undertaken without special permission. Cars should be sent home, or else owners asked for disposition. This does not mean repairs to the extent of \$200.00 on foreign cars can be undertaken promiscuously. The age, capacity, and physical condition of the car have to be considered, and good judgment must be used. However, cars must not be set aside and *per diem* allowed to accrue. A decision should be made as soon as the car reaches repair tracks, and if owners have to be communicated with, the matter taken up quickly and vigorously.

In cases of foreign cars for which material is required from owners in order to make repairs, no time must be lost in making original request, and unless received within thirty days mailgram is to be sent to the Master Car Builder, who will handle with car owners or report the facts to the G. S. M. P., Chicago.

Mather Stock Cars, bearing C. M. & St. P. initials and numbered 89,000 to 90,000 are to be treated as foreign cars. When repairs to these cars are heavy, the policy will be to send them home to owners at Chicago. If cost of repairs to a car will exceed \$40.00, wire asking disposition, is to be sent

M. C. B., stating car number, repairs necessary, and what would need be done to put car in safe condition to run to Chicago. Should car be awaiting loading, however, it should be handled locally, using good judgment.

C. T. H. & S. E. cars will be handled as foreign cars in so far as billing is concerned, but will be treated in accordance with all Standard Practices for system cars. These cars will be handled for repairs on C. T. H. & S. E. Division as far as practicable.

Sub-para. (II) SENDING CARS HOME

In sending foreign cars home (whether bad order or not) full routing must be shown on waybill, in order to prevent cars being set out at junction points and held for disposition.

Foreign cars received with temporary fixtures applied, such as false floors to refrigerators, must be returned in the same condition as received. These false floors are generally stencilled with name of owning road, and if found loose will be promptly returned.

**Sub-para. (III) WORK WHICH CANNOT BE BILLED
FOR TO BE AVOIDED**

In repairing foreign cars the application of Grip Union Nuts, Grip Lock Nuts, Boss Lock or similar nuts cannot be billed for unless standard to the car. They will therefore not be applied unless necessary for safety.

**Para. 4 FREIGHT CAR REPAIRS (SYSTEM AND
FOREIGN)**

Sub-para. (I) GENERAL

In addition to the rules laid down for the repair of system cars, and those given for handling foreign cars, there are a number of matters which pertain equally to system and foreign cars, given under the sub-paragraphs following:

Sub-para. (II) TRANSFERRING LOADS

The responsibility for transferring loads rests with car foreman at point where car is located. Before transferring a load it should be definitely established that car cannot be satisfactorily repaired under load. Many claims result from the transferring of loads, and this should be remembered and every precaution taken to guard against loss during transfer. The same type of car is to be used to transfer load to, should there be any possibility of anything being involved in handling at destination. For instance, coal in a self clearing car should not be loaded into a flat bottom, or vice versa.

Where sufficient help is not available to transfer a load Car Foreman will take up with Transportation Department, stating necessity in detail, who in turn will furnish the required number of men.

The number of the seal broken and of the seal applied will be kept. When it is necessary to transfer a valuable shipment, such as furniture, merchandise, machinery, or finished and manufactured products, Car Fore-

man will call on the Agent to break the seal and to be in a position to testify that no unnecessary damage is done in transferring load.

In transferring a load being forwarded under Government seal, the following (obtained from the U. S. Customs Service) will govern:

“There are two classes of movement, viz.: (1) cars passing *through* the U. S. A. from a point in one foreign country to a point in another foreign country, handled under what is known as ‘T. & E. Entry’ (transportation and exportation entry), and (2) cars originating at or destined to a point *within* the U. S. A., handled under what is termed ‘I. T. Entry’ (in transit entry) or ‘T. B. Entry’ (transportation in bond).

“In the case of a ‘T. & E. Entry’ car (passing *through* the U. S. A.) the load can only be transferred under Customs’ Supervision.

“With shipments made under ‘I. T.’ or ‘T. B. Entry’ (originating at or destined to points *within* the U. S. A.) transfer may be made without the supervision of Customs’ Officials, (but Car Foremen or Inspectors will in all cases notify the local agent or superintendent, and have them attend and break the seal). The person supervising the transfer of a shipment will note on the special manifest over his signature the date and reasons for the transfer, and notify the chief officer of the Customs at the port of destination of such action.”

When a load is transferred, the following must be complied with:

Local agent notified, giving billing reference and details so that he may report condition of load at time.

If perishable freight, a copy of report will be sent to Supervisor of Refrigerator Service, Chicago.

If transferred, or adjusted, on authority for transfer or adjustment, as in cases of loads received from connecting lines, the authority must be sent to the Division Accountant, who will render bill against responsible carriers.

If load is under Government seal, the Chief Officer of Customs at port (place) of destination is to be notified.

All loads transferred or adjusted will be reported weekly to the Master Car Builder (Form CD21), a copy of which is to be sent direct to General Superintendent of Transportation, Chicago.

Sub-para. (III)

WEIGHING CARS

When cars are built they must be weighed and the light weight (nearest 100 lbs.—exact 50 lbs. use lower multiple) stencilled on them.

Wooden cars, or composite cars (excepting refrigerators) are to be re-weighed each year for first two years they are in service, and thereafter once every two years.

All-steel and refrigerator cars are to be re-weighed every three years.

Cars materially changed by repairs, alterations or repainting, should be re-weighed. All cars re-weighed must be re-marked.

A. R. A. rules 30 and 31 give details of the method of weighing and of marking cars.

We are advised, on the part of the Western Weighing and Inspection Bureau, that their weighmasters weigh a great many cars of our lines, and it has been their experience that the light weight as stencilled requires correcting, but for various reasons this has not been done in many cases. A review of this matter indicates that large number of cars are weighed on our line by those association weighmasters employed by different industries at Minneapolis, Dubuque, Kansas City, Ottumwa, Beloit, Green Bay, Moline, Milwaukee, Mayville, Rockford, Freeport and other points. Inasmuch as these men are not employees of this company, it is not consistent to require that they re-stencil the cars, but it is desired that our men call upon these weighmasters employed at various industries on our lines for their records of cars that have been weighed light and found incorrectly stencilled, and re-stencil any such that may be available on the industry tracks, providing, of course, that the weather conditions are satisfactory and it is known that the light weight given presents the actual light weight. See that the cars which are weighed are thoroughly cleaned and that the weight obtained and applied is reliable. If the cars contain dirt and rubbish, this must first be removed. Should the quantity of debris in the car be such as to make it impractical to handle it in the weighing and repair yard, place the matter before the proper officer in the operating department, requesting that the cars be moved to some outlying point where the cleaning can be done, and then have the cars returned for re-weighing.

In the performance of their duties, weighmasters of the Western Railway Weighing Association will affix a suitable triangle card, as indicated below, to each side of every car weighed by them, which, when weighed in a clean condition, shows a variation of 500 pounds or more from the stencilled tare. It is desired that in all cases where this card is found by carmen, that the correct weight be stencilled on the car. This arrangement will assist materially in eliminating the incorrect stencilling of cars.

Form 247
 Date.....
 At.....
 Car No.....Int.....
 Actual Tare.....

 Weighmaster
 WEIGHED EMPTY BY
 WESTERN RY. WEIGHING ASSN.

In order to keep our equipment re-weighed it is necessary that the matter be handled systematically. In rough round figures we have 63,000 composite cars and 3,000 refrigerators and all-steel cars. The former have to be weighed every two years—or 31,500 per year—and the latter every three years—or 1,000 per year, making a total of 32,500 cars per year to

weigh, *equal to more than 2700 cars each month*. This does not take into consideration new cars, whose weighing periods are more frequent, nor foreign equipment on line in excess of ownership. (Cars off the line will, normally, balance foreign cars on the road, in respect to re-weighing.)

To meet requirements the following allotment of cars must be re-weighed each month. This can be done on an average basis, but over a period of one year the ratio must be fully maintained. Each district will arrange its own apportioning of work, and will vary it to comply with fluctuating conditions:

Minimum Average Number of Cars to be Re-weighed Monthly			
	Refrigerator and All Steel	All Other Cars	Total
Lines West	20	580	600
Northern District	15	385	400
Middle District	20	630	650
Milwaukee Shops	10	240	250
Southern District	20	680	700
C. T. H. & S. E.	5	145	150
Monthly Totals	90	2660	2750

Sub-para. (IV) RENUMBERING AND RESTENCILLING

This will be done in order to keep cars in such condition that no doubt whatever will exist as to numbers and initials of cars passing interchange. Numbers and initials will be brightened up when necessary, but where any appreciable amount of work is to be done the number, or initials, or both, will be completely restencilled.

If there is not sufficient paint on car to properly retain the new stencilling and condition of car does not justify entire repainting, one coat should be applied as a panel back of the stencilling so that the paint used in applying the numbers and letters will hold, otherwise the marking applied will soon become illegible and make it necessary to again apply the identity marking within a short period.

Sub-para. (V) HAND BRAKES

These must be given an actual test as they pass over repair tracks, to see that they are operating properly.

Sub-para. (VI) COUPLER HEIGHTS

Correct coupler height of 31½" minimum and 34½" maximum, above rail to center of face of knuckle, must be maintained at all times. This should not be obtained by shimming between carrier iron and coupler shank, when car is on repair track, but is to be obtained by shimming up truck springs if practicable, or else center plates and side bearings. If neither course can be followed, then adjust by shimming between arch bars and journal box on arch bar trucks. Where shims on carrier irons have been applied they should be removed, and car adjusted as described.

Sub-para. (VII) TRUCKSIDES AND TRUCK FRAMES

Derailments and other classes of road failures, often cause trucks to go into service temporarily with arch bars and frames bent laterally in the

center; this is not only dangerous, but a regrettable practice. Inspectors are cautioned to watch closely for such defects and not permit cars to remain in service when in this condition, and repair tracks must positively prevent cars leaving until rectified. Arch bars must not be welded.

Cast steel truckside frames are not considered safe for service when found cracked. Such frames should be repaired by welding with oxy-acetylene or with electric welding apparatus, or they should be replaced with new ones. (Arch bars positively must not be welded.)

The fact that so many cast steel side frames and cast steel bolsters are failing in the tension (lower length of the truss) members, is conclusive evidence of weakness in design and the welding of the fractures will not add to the strength, but is likely to introduce a condition of further weakness by improper workmanship and change in the structure of the metal. It is, therefore, necessary to confine acetylene or electric welding within specified limits on structures subject to alienating stresses, as experienced in truck side frames and bolsters.

(See Standard Practices for details of welding.)

Truck bolsters and spring beams should be carefully inspected to see that they are secured to place properly and are not cracked or broken, making them unsafe for service.

Sub-para. (VIII) TRUCKS AND BRAKE RIGGING

Investigations carried on from time to time have developed that upon the removal of the brake hangers and pins from a number of cars they were found to be about half worn through. It is apparent that these parts have been in service for a long time and that they are very rarely, if ever, inspected excepting when brake beams or hangers fail. It is a paying investment, whenever cars reach repair tracks, to have all the brake hanger pins and bolts removed for inspection and renewal when found necessary.

With this end in view a system should be inaugurated at all stations whereby cars reaching repair tracks will have the trucks carefully looked over and the renewals made of any parts showing undue wear, and particular attention should be given to the column and oil box bolts and nuts; in fact, it should be our purpose not to allow any car to leave a repair track without the trucks receiving a thorough going over and being put in good repair.

For system cars, the various types of standard brake hangers and safety hangers are covered by drawing 20730-B and also our standard brake beams furnished are equipped with three openings, namely, for the pot hook hanger, for the intermediate stirrup type hanger and for the center suspension hanger, with the thought that the brake hanger can be changed in case the pot hook eye is worn, thus avoiding the necessity of having to change the entire brake beam.

Sub-para. (IX) COUPLER DEFECTS

Cars must leave repair tracks with couplers in other than first class condition, but this can only be accomplished by knowing the prevalent defects in the different types of couplers and how to detect them.

The following information will be very valuable to Foremen and inspectors:

Type D Coupler: Lock lift bent or twisted.

Sharon Coupler: Lock block broken. (Discovered by tit missing on left side or tit not moving when lever is raised.) Coupler head crushed. (Prevents raising top plugs.)

Major Coupler Top Lift: Uncoupling chain kinked in coupler head. (Prevented by applying cotter or split washer.) Lock-block broken or badly worn. (Discovered by cutting cars and examining interior of coupler.

Major Coupler, Undershot: Lock-block broken or badly worn. (See explanation for top lift Major.) Bent bell crank. (Causes lift arm to miss slot in bottom of coupler. The same effect is sometimes caused by bell crank being fastened on with too small a bolt, allowing too much side play.)

Pitt Freight Coupler: Broken lock-block. (Discovered by round tit missing from bottom of lock-block.) Lock-block key missing. (Discovered by key missing. Detected by outside inspection. The absence of this key also causes trigger to lose out of coupler.) Lock-block pulls out. (Caused by above defects or by catch or lug being broken off left side of lock-block.)

Latrobe Coupler: Bent lock-block. (Discovered by offset or bend at bottom of lock-block pointing differently than parallel with rails.) Broken lock-block. (Discovered by absence of offset or bend at bottom of lock-block.) (Both of the above defects are easily detected by outside inspection and either will allow lock-block to pull through head of coupler.) Worn coupler head. (Hole in bottom wall of coupler sometimes gets worn sufficiently to allow even a new lock-block to pull out through top of coupler and can only be detected by cutting car and making careful examination.) Coupler out of contour. (Usually caused by elongated pin holes.)

Simplex: Lock-block broken. (Tit or lugs on rear end of lock-block gets broken off allowing block to work forward so that it cannot be raised. This is usually indicated by inability to raise the lock lift to its usual height when slack is shoved in, but this test is not infallible as much the same result is found when lock lift is bent or twisted. To be absolutely sure, it is necessary to separate cars so that the lock-block can be taken out.) Lock lift bent or twisted. (This defect is difficult to find without cutting cars but can sometimes be found by feeling with uncoupling lever. In testing for this defect push in on knuckle and raise lever. If bent or twisted sufficiently the bottom of lock lift will come forward in front of tail of knuckle, causing inoperative lock-block.)

Climax "A" or High Horn: (This is the old high horn with narrow lock-block.) Inoperative lock-block. (Caused by ribs or "Kidneys" in side wall of coupler becoming worn sufficiently so that tail of knuckle goes back far enough to allow lock-block to pull up in front of tail of knuckle and when this condition obtains you invariably have an inoperative coupler.

Cannot be detected by casual outside inspection. To test coupler for this defect, push in on knuckle and raise uncoupling lever.) Uncoupling chain kinked in head of coupler. (Prevented same as in Major top lift or Tower top lift, by cotter or split washer.) Coupler out of contour. (Usually caused by elongated pin holes.) The proper lock-block for this coupler is the "A" block, which is the high, narrow block, and is $2\frac{5}{8}$ " wide at toe. (None other can be used without altering.)

Climax High Horn "B": (This is the high horn with high, wide, lock-block.) (Defect peculiar to the "A" Type are also found in this coupler and can be found in the same way as described above.) The proper lock-block for this head is the high, wide lock-block which is $3\frac{1}{8}$ " wide at the toe and is known as the "B" block. Both the "A" and "B" blocks are $7\frac{3}{4}$ " high and are $1\text{-}13/16$ " higher than the "C" block for the low head.

Climax "C" or Low Head: Uncoupling chain kinked in coupler head. (See above for remedy.) Inoperative coupler. (This is usually caused by using the "A" block in this head and results in the lock-block lifting up in front of the tail of the knuckle, rendering the coupler inoperative. When this block is used the lock to the lock or knuckle throw is not obtained as the top of the high lock strikes the upper wall of the head before the fulcrum shoulder comes in contact with the fulcrum point in the chamber of the coupler head. This defect can usually be detected by noticing that the top of the lock lift is sticking unusually far upward out of coupler head or by feeling the bottom of the lock with the fingers, but can absolutely be detected by testing as described for the "A" head, viz.: by pushing in on knuckle and raising lever. The proper lock for this coupler is the "C" lock which is $3\frac{1}{8}$ " wide at the toe and $5\text{-}15/16$ " high from bottom of toe to center of hole for fastening lock lift. The inside walls of this coupler sometimes become worn the same as the high heads do and produce the same results and can be found as described above.) All Climax couplers are prone to have elongated knuckle pin holes.

Tower Coupler: Uncoupling chain kinked in coupler head. (Detected by testing with lever. For remedy see Top Lift Major and Climax.) Broken lock-block. (Detected same as in a Sharon Coupler.) Tower couplers have many worn contours caused by worn coupler head, worn knuckles, worn lock-block, or elongated knuckle pin holes or a combination of these four defects. (Sharon coupler is an improved Tower.)

Gould Coupler: Broken lock-blocks. (Discovered by lifting levers.)

Lion Coupler: Very complicated. Defects not easily discovered by casual outside inspection, and coupler must usually be taken apart to find defects.

Chicago Coupler: Lock-block disconnected from lock lift. (This is an internal defect and often allows lock-block to work ahead so that it cannot be raised. It can usually be detected by trying the lever, when the lock lift will pull out through top of coupler head.)

Janney, Old: Cotter key missing from bottom of lock-block, allowing block to pull out.

Janney X: Must be examined internally for defects, which are not readily discovered by outside inspection.

R. E. Janney: This coupler is made in two types, the heavier lock-block being the improved type. Both locks bend and will not straighten without breaking. When the smaller one is used in the head designed for the larger type it will sometimes pull through the top of coupler head. Be particular that the proper block is used in making repairs.

Munton and Melrose: These couplers are very similar and the top of their lock-blocks are similar to the top of the Latrobe lock-block, both being in two parts. A bolt or key sticks through the back of the head and if missing, badly worn or too small allows the lock-block to pull out of the top of the coupler head.

Monarch: Trigger worn, bent, broken or missing. Lock-block worn, bent or broken. (Either of these defects usually allow lock-block to pull out of top of coupler head. Try levers to discover these defects.)

Penn Coupler: Practically all defects peculiar to this coupler are discoverable by internal examination only.

Broken lock-blocks predominate in the following couplers: Pitt, Latrobe, R. E. Janney and Sharon. Bent lock-blocks, allowing lock mechanism to work out, predominate on the following couplers: Latrobe and R. E. Janney.

Special note on Climax Couplers: The original Climax Coupler was the "A" coupler—or commonly known as the High Horn Climax. This coupler used the high, narrow lock-block which is $2\frac{5}{8}$ " wide at the toe of the block. After this coupler had been in service for some time it was found that the lock-block was so narrow that when the ribs in the back wall of the coupler were away it would allow the knuckle to go far enough back so that when the lever was raised the toe of the lock-block would come up in front of the tail of the knuckle, thus rendering the coupler inoperative.

In order to overcome this fault a new coupler was designed. This was also a high head coupler and known as the "B" Climax and in this coupler a lock-block $3\frac{1}{8}$ " wide at the toe was used.

Sometime later, on account of difficulty experienced in applying these couplers to a certain type of flat cars on the Harriman Lines, another new type was designed. This was a low head coupler and was known as the "C" Climax. This coupler also had the toe of the lock-block $3\frac{1}{8}$ " wide but was $1\text{-}13/16$ " shorter from the toe of the lock-block to the center of the eye for fastening the lock-lift.

These three blocks are of similar design, the difference being in the size—the "A" block being $2\frac{5}{8}$ " wide at the toe and $7\frac{3}{4}$ " from toe to center of eye; the "B" block being $3\frac{1}{8}$ " wide at the toe and $7\frac{3}{4}$ " from toe to center of eye, while the "C" block is $3\frac{1}{8}$ " wide at the toe but only $5\text{-}15/16$ " from toe to center of eye.

It will be thus seen that it is impossible to use either the "B" or the "C" block in the "A" coupler without grinding off the extra width of the

toe. It is, however, possible to use either an "A" or a "B" block in the "C" coupler as the "C" coupler is nothing more than the "B" coupler with the head cut down to its present height.

Then either the "A" or "B" block is used in the "C" coupler we get practically perfect lock condition and a practically perfect Lock Set condition. They should not be used, however, as we do not get the lock-to-the-lock nor do we get the knuckle throw for the reason that the top of the high lock strikes the upper wall of the coupler before the fulcrum shoulder comes in contact with the fulcrum point in the chamber of the bar. But the most important reason why the "A" lock should not be used in the "C" coupler is that in doing so, when the lever is raised the toe of the lock-block is pulled up in front of the tail of the knuckle, thus rendering the coupler inoperative, which defect the "B" and "C" couplers were designed to correct. It has been found, however, in some of the "B" and "C" couplers that they, too, sometimes become worn as did the old "A" type so that the knuckle will sometimes go far enough back to allow the toe of the lock-block to be pulled up in front of the tail of the knuckle. Care in testing these couplers with the knuckle pushed in as far as it will go will disclose this defect.

For high head Climax couplers, if the hole in the bottom of the coupler through which the toe of the lock-block drops is only $2\frac{3}{4}$ " wide, the "A" lock-block should be used, while if the hole is $3\frac{1}{4}$ " wide the "B" lock-block should be used. In all the low head Climax couplers this hole should be $3\frac{1}{4}$ " wide and only the "C" lock-block should be used.

In inspecting couplers or uncoupling mechanism it is of the utmost importance that *all* levers be tried. In doing so it will be found necessary to cut but few cars, but if in doubt as to whether or not a coupler is working properly never hesitate to cut a car.

To test a coupler when the car is not coupled to another car, *always* push in on the knuckle before attempting to operate uncoupling lever.

If parts are badly worn, or for other causes, are not working properly, it is better to renew them than to subject some employee to the risk of getting hurt or to subject the Company to a fine. Don't be "penny wise and pound foolish."

Cotter keys are not to be applied to knuckle pins of couplers on cars other than hopper and fixed end gondola.

In fitting up couplers in freight equipment cars it should be arranged to have one and one-quarter inches clearance each side, that is, between outside face of shank and inside face of draft sill, also clearance between top of shank and under side of opening in end sill to be $\frac{3}{4}$ of an inch.

Sub-para. (X)

COUPLER YOKES

Coupler yokes are to be gibbed wherever possible to neatly fit the end of the draw bar butt and thus relieve the rivets of as much shearing strain as possible.

Sub-para. (XI) COUPLER CARRIER IRONS

All coupler carrier irons must be held in place by at least four bolts if placed vertically and one bolt through necessary casting if placed horizontally, all securely fastened in place. On wooden draft timber system cars, coupler carriers are to be gibbed or turned up on the ends to avoid draft sills splitting or breaking away.

Sub-para. (XII) KEYWAYS IN DRAFT TIMBERS AND WOODEN CENTER SILLS

When applying new center sills, one keyway only must be cut in sill, omitting keyway nearest to end sill. When applying new draft timbers, one keyway only must be cut in timber; the keyway in center sill corresponding to the keyway omitted in draft timber and should be filled with a piece of wood nailed in place.

Sub-para. (XIII) TESTING OF TANK CARS AND THEIR SAFETY VALVES

Transportation requirements prescribe that "a tank which does not meet the required tests shall be withdrawn from transportation service." The A. R. A. has prescribed standard method and periods for tests, and the Interstate Commerce Commission has framed certain rules for the safe handling of these cars and their contents, which information is published for guidance.

Cars are divided into five classes, known as Class I to Class V, and the period of test for each class as prescribed by A. R. A. specifications is as follows:

Class I. Tanks shall be tested at intervals of not over five years, and any tank damaged to the extent of requiring patching or renewal of one or more sheets, or extensive reriveting or recalking of seams, shall be retested before being returned to service.

[Note: Above provision is suspended for cars due for test prior to January 1st, 1923, except when such cars are shopped for repairs. New cars or cars damaged requiring patching, etc., are not exempted from test.]

Class II and III. Tanks shall be tested before being put into service, again at the expiration of ten years, and after that at intervals of not over five years; with the exception that where tanks are used for the transportation of such corrosive products that deterioration is to be expected in a shorter time, the first test period for such tanks shall be reduced to five years. Tanks requiring this five-year test shall be those used for the transportation of chemicals, such as acids, ammonia, liquors, etc., and such other products as may hereafter be specified, and any tank damaged to the extent of requiring patching or renewal of one or more sheets, or extensive riveting or recalking of seams, shall be retested before being returned to service.

[Note: Above provision is suspended for cars due for test prior to January 1st, 1923, except when such cars are shopped for repairs. New cars or cars damaged requiring patching, etc., are not exempted from test.]

Class IV. Tanks shall be tested before being put into service, and after that at intervals of not over five years, and any tank damaged to the extent

of requiring patching or removal of one or more sheets, or extensive riveting or recalking of seams, shall be retested before being returned to service.

[Note: Above provision is suspended for cars due for test prior to January 1st, 1923, except when such cars are shopped for repairs. New cars or cars damaged requiring patching, etc., are not exempted from test.]

Class V. Tanks shall be tested before being put into service, and after that at intervals of not over two years, and any tank damaged to the extent of requiring patching or renewal of one or more sheets, shall be retested before being returned to service.

The pressures and method of test of tanks shall be as follows:

Classes I and II (Either 40 or 60 lbs. per sq. inch), *Class III* (60 lbs. per sq. inch), *Class IV* (75 lbs. per sq. inch) will be tested by completely filling the tank with water, or other approved liquid safe to use, of a temperature which shall not exceed 70 degrees F. during the test, and applying the pressure in any suitable manner. The tank shall hold the prescribed pressure for not less than ten minutes without leak or evidence of distress after the tank has been calked tight.

[Note: Above provision is suspended for cars due for test prior to January 1st, 1923, except when such cars are shopped for repairs. New cars or cars damaged requiring patching, etc., are not exempted from test.]

Class V will be tested as for other classes, at a pressure of 300 lbs. per square inch, and the tank shall hold the prescribed pressure for not less than thirty minutes without any leak whatever. Calking to stop leaks developed during the test will not be permitted.

When tanks are tested, the date, pressure to which tested, place where test was made, and by whom, shall be stencilled on the tank in accordance with the Master Car Builders' Standard Marking for Freight Cars.

The test for Safety Valves will be made as follows:

Classes I, II, III, and IV shall be tested at intervals of not over two years, and on new cars before placing in service. The test may be made without the removal of the valve from the car, providing the valve unseats at a total pressure corresponding with the area of the seat multiplied by the required pressure.

Class V shall be tested as above, at intervals of not over six months.

When valves are tested, the date, pressure to which tested, place where test was made, and by whom, shall be stencilled on the tank in accordance with the Master Car Builders' Standard Marking for Freight Cars.

The pressure to which the valves shall be set are as follows:

Classes I and II. Products with flash point below 20 degrees F., valves shall be set at 25 pounds. Products with flash point 20 degrees at 150 degrees F., valves may be set to 12 pounds.

Class III. Valves shall be set at 25 pounds.

Class IV. Valves shall be set at 25 pounds.

Class V. Valves shall be set at 200 pounds.

The Interstate Commerce Commission rulings for the handling of tank cars are as follows:

Tests of all tank cars and their safety valves, as made in compliance with Master Car Builders' rules, must be certified by the party making the tests to the owner of the tank car and to the Chief Inspector, Bureau of Explosives; and this certification must show the initials and number of the tank car, the service for which it is suitable, the date of test, place of test and by whom made.

After May 1, 1915, a tank car must be used for shipping inflammable liquids with flash point lower than 20 degrees F., unless it has been tested with cold water of 60 pounds per square inch and stencilled as required by Master Car Builders' rules.**

All Foremen are to be in possession of a copy of Standard Specifications for Tank Cars, which may be obtained upon application to the Master Car Builder's office. The more important interchange points have been equipped with apparatus for making the prescribed tests. Certification of Test must be made by the party making the test, to the owner of the tank car and to the Chief Inspector, Bureau of Explosives. This will be done on Form B. E. Form 17-A, three copies of which are to be filled in, one going direct to the Bureau of Explosives, the second attached to Billing Repair Card, and the third kept on file.

Sub-Para. (XIV)

ROAD WORK

It is not proper to send men out on the road to repair cars with broken train lines, defective air brake equipment, framing or truck members, if it is at all possible to get the car safely to some repair station by hauling it behind the caboose, care being exercised, of course, to see that loaded cars are not delayed unnecessarily and backhauled too greatly in case there are no means available for turning the car. When cars are set out by trainmen they should be placed conveniently so that the carman can get off a passenger train and go to work without having to drag his tools and material half a mile or more to attend a car which could just as easily have been set out on the stock track near the station in place of some interchange track inconveniently located.

Men doing road work who cannot get into their home station without making unavoidable overtime, due to lack of convenient train service, must take it upon themselves to go over any cars which are located adjacent or within easy reach of the car which they repaired, giving them such necessary attention as to fit them up for service, besides making every adequate repair

**Note. For casing head gasoline, blended or unblended with other products, and with vapor tension not exceeding 10 pounds, tank cars, 60-pound test class, must have safety valves set to operate at 25 pounds per square inch, and provided with "fool proof" dome covers.

For all other liquids with flash points lower than 20 degrees F., safety valves must be set to operate at 25 pounds and "fool proof" dome covers must be provided.

within their power to the car which they were sent out to take care of. Good judgment is necessary and roadmen should be checked up to see how many work cars they deliver showing actual repairs made, and they should interest themselves to carry sufficient cotter keys, nuts, small bolts and other items with them so as to provide for any eventuality. In any case, they can take care of the packing on a number of cars without additional material, all of which should be properly reported. All supervisors should interest themselves to the extent of seeing that this matter is followed up from day to day. (A proportion of the expense is chargeable to transportation account, namely, that spent in the attention given oiling and packing of boxes, closing side doors, classifying cars for various loading, etc. Of course, the time actually spent repairing the equipment is chargeable to car repairs.)

Sub-para. (XV)**DRAFT TIMBERS**

Draft timbers must *not* be spliced.

Sub-para. (XVI)**ROOFS**

Roofs of cars on repair tracks must be inspected and if inside metal roofs or double board plastic roofs have outside boards loose, the loose nails must be drawn and boards renailed with two nails, staggered in each board at each purline, side plate and ridge pole. In renailing care must be taken to use proper sized nails, so that metal roofing will not be punctured, correct size being $2\frac{1}{4}$ " No. 2 barbed wire.

All nail holes left open after renailing are to be carefully and properly filled with "Sarco," "Bako" solder or other suitable ingredient to prevent leakage.

Where bolts are employed to hold roof structures or roofing in place, all bolts are to be tightened up through ridge pole, car-lines, running board brackets, etc., and have nut locks or lock nuts applied to prevent structure from again becoming loose. Where suitable means are not available for holding the nuts in place, either through lack of material or nature of repairs, cut the threads of bolt with chisel to prevent nuts coming off.

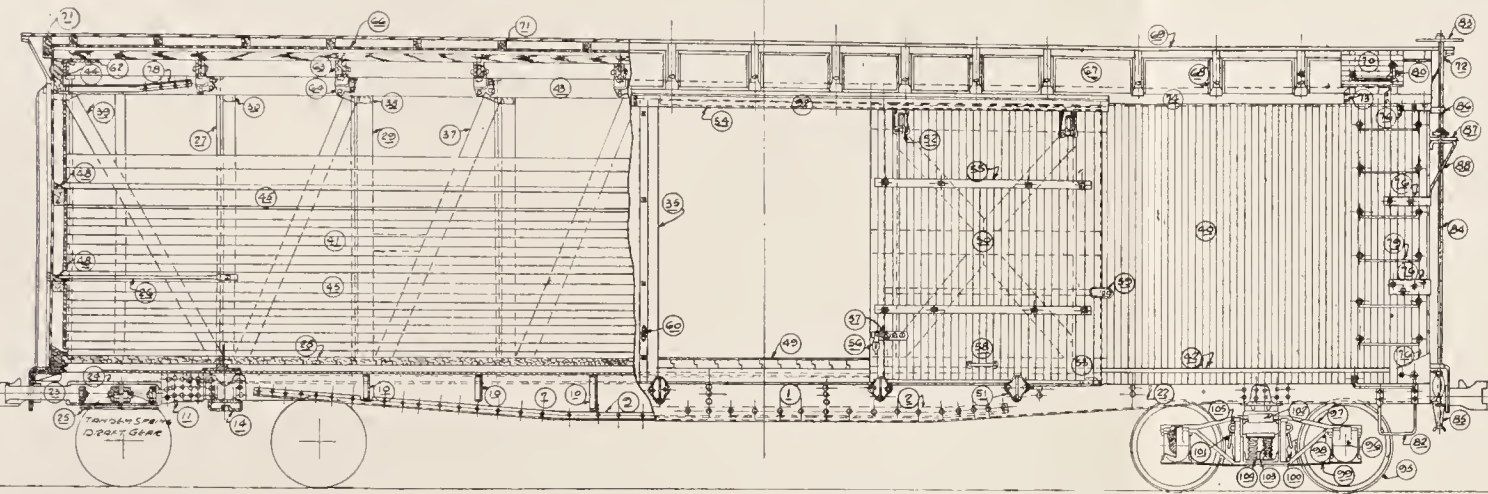
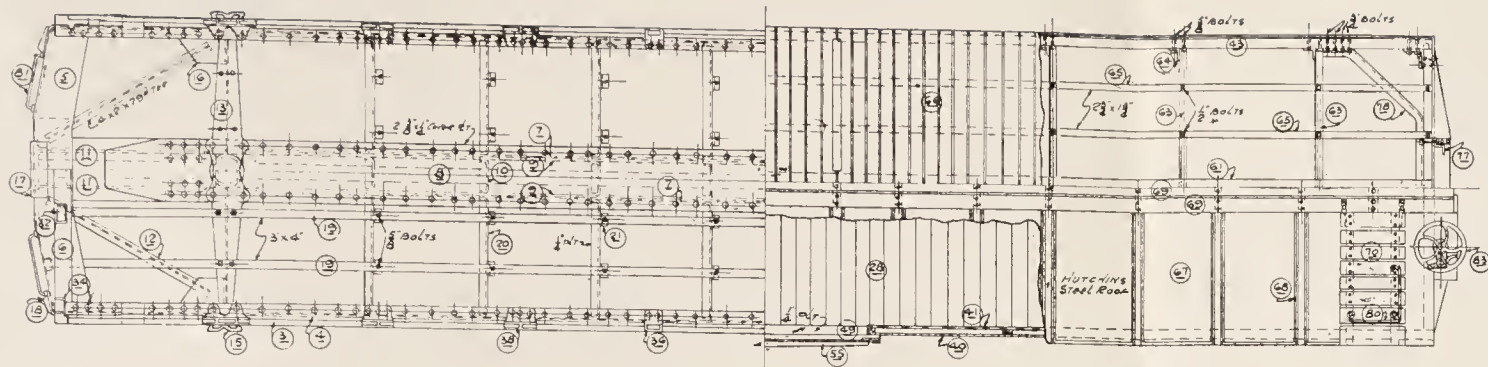
Wooden running board saddles must be secured to ridge pole by two $4\frac{1}{2}$ " No. 18 screws and at the ends by two $4\frac{1}{2}$ " No. 18 screws.

Running boards, when loose, must be secured in place by $2\frac{1}{2}$ " No. 16 screws, two per board at each saddle.

All roof handholds must be tested by hand or with bar to make quite certain they are securely fastened. An insecure handhold unless corrected will most likely result in injury to an employee.

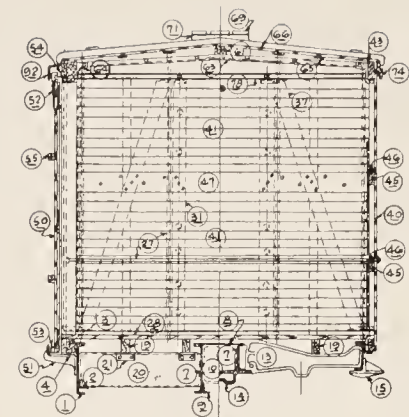
Sub-para. (XVII)**TRUSS RODS**

Truss rods must be tight in order to properly perform their allotted function of carrying the load. As cars go over tracks they must be properly tightened, and car drawn up to proper camber ($1\frac{1}{2}$ " in center). Turn-buckles should be properly secured from turning, truss rod saddles, struts and needle beams should be thoroughly held in place and function properly at all times.

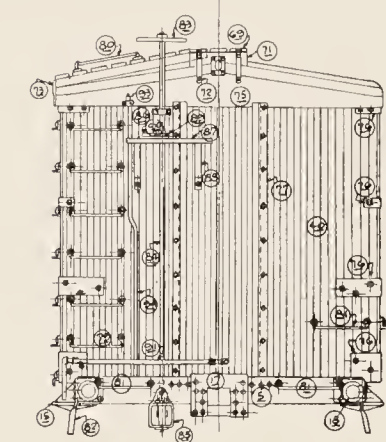


HALF LONGITUDINAL SECTION
AT CENTER SILL

HALF SIDE ELEVATION



CROSS SECTION
AT DOOR



CROSS SECTION
AT BOLSTER

END ELEVATION

1. SIDE SILL
2. SIDE SILL CORNER RAIL
3. SUB SIDE SILL HEAD
4. SUB SIDE SILL SUPPORT
5. PRESSURE STEEL END SILL
6. SUB END SILL WOOD
7. CENTER SILL
8. CENTER SILL COVER PLATE
9. CENTER SILL BOTTOM CHANNEL
10. CENTER SILL SEPARATOR
11. DOOR SILL
12. END SILL DIAGONAL BRACE
13. BOLSTER
14. CENTER PLATE BODY
15. ROOFING & JACKING PLATE
16. GUSSET PLATE
17. SPRING PLATE
18. RAIL DOCK POCKET
19. NAILING STRIP
20. NAILING STRIP CROSS TIE
21. NAILING STRIP SUPPORT

22. HOOK
23. DRAW BAR
24. DRAW BAR YOK
25. DOOR GEAR CARRIER
26. TIE STRAP
27. TIE RODS
28. FLOOR
29. POST
30. POST POCKET
31. END POST
32. END POST POCKET
33. CORNER POST
34. CORNER POST POCKET
35. DOOR POST
36. DOOR POST POCKET
37. BRACE
38. CORNER POST & BRACE POCKET
39. COUNTER BRACE
40. S-EATHING OR SIO Y
41. INSIDE LINING
42. SHEATHING STRAP

43. SIDE PLATE
44. END PLATE
45. BOLT RAIL
46. BOLT RAIL GRAY STRIP
47. END BOLT RAIL
48. END BOLT RAIL GRAY STRIP
49. DOOR THRESHOLD
50. DOOR
51. DOOR ARCHIT
52. DOOR HATCH
53. DOOR SIDE
54. DOOR TRAIL
55. DOOR BRACE
56. DOOR HASP
57. DOOR HASP KEY
58. DOOR HANDLE
59. DOOR STOP
60. DOOR LOCK
61. RIDGE POLE
62. RAIL DOCK CONY
63. CAR. Y

64. CARLINE SUPPORT
65. PURLIN
66. ROOF BOARDS
67. ROOF SHEETS
68. ROOF SHEET CARLINE
69. RUNNING BOARDS
70. EXTENSION RUNNING BOARD
71. RUNNING BOARD SADDLE
72. RUNNING BOARD ARCHIT
73. EXTENSION RUNNING BOARD ARCHIT
74. SIDE FASCIA
75. END FASCIA
76. CORNER BAND
77. END POST I-BAR
78. END REINFORCING BRACE
79. LINDOR TIE ROD
80. ROOF HANDHOLD
81. HANDHOLD
82. SILL STEP
83. BRAKE HAND WHEEL
84. BRAKE SHOT

85. BRAKE SHOT STEP
86. BRAKE SHOT ARCHIT
87. BRAKE STEP
88. BRAKE STEP ARCHIT
89. BRAKE RATCHET WHEEL
90. BRAKE PAUL
91. UNCOUPLING LEVER & ROD
92. HOUSING
93. RETAINER VALVE
94. RETAINER VALVE PIPE
95. WHEEL
96. JOURNAL BOX
97. TOP ARCH BAR
98. BOTTOM ARCH BAR
99. ZEE BAR
100. BRAKE HEAD
101. BRAKE HANGER
102. TRUCK BOLSTER
103. TRUCK SPRING
104. SPRING PLANK
105. TRUCK COLUMN

BOX CAR CHART
C.M. & ST. PAUL R.R.
OFFICE
MASTER CAR BUILDER
MILWAUKEE SHOPS, WIS.

Saddles are to be properly located, and truss rod nuts on end sill to have full bearing and full thread, engaging entire length of nut or turn-buckle.

Sub-para. (XVIII)

AIR BRAKES

Air brakes will be handled in accordance with rules governing, but the exhaust ports of all retainers are to be examined to see that they are clean, as their being blocked up is a frequent cause of trouble in train operation.

Sub-para. (XIX)

COOPERING CARS FOR GRAIN

During the heavy grain movement period it becomes necessary to utilize every possible car for hauling grain. Many cars are ordinarily unfit for grain loading, but by lining with Kennedy paper or patching with tin (old roofing) can be utilized in this service. In carrying out this work good judgment should be used, as otherwise heavy claims will result. Cooped cars must as far as possible be used for short hauls, and these remarks should be read in conjunction with grain car requirements (Section 1, para. 2, sub-para. II).

Sub-para. (XX)

PAINTING

The preservation of freight car equipment of railroads will be maintained by necessary repainting. When paint on freight equipment cars has become perished to the extent of permitting the steel to rust and deteriorate, or the wood to become exposed to the weather, they should be repainted. The car body (including roof) should be entirely repainted if for any reason it is found necessary to repaint one-third or more of the car. Before applying paint to steel, it should be scraped so as to clean off all blisters and loose paint including removal of protruding nails and tacks.

When repainting freight equipment cars, two coats will be applied to all new parts, and old parts of body which have been reworked causing removal of paint. One coat will be applied to parts where old paint is in good condition. Should the old paint be found in such condition requiring two coats, they may be applied. (See Standard Practices for details of painting various types of equipment.)

Detention of equipment from service for painting should be avoided, when possible. A great deal of this work can be done to open cars in transportation yards when under load in storage.

Note. To enable readers to more readily follow the preceding instructions in regard to the repair of freight cars, a print of a box car, showing names of various parts, is shown below.

Para. 5 PASSENGER CAR REPAIRS (SYSTEM)**Sub-para. (I) SHOPPING SCHEDULE**

Passenger cars are sent to the shops periodically for overhaul and repair. The times between shoppings are shown in the following table:

Due for Shopping every 14 months

Steel Coaches
Steel Diners
Steel Tourist Cars
Steel Parlor Cars
Steel Sleeper Cars
Steel Sleeper Compartment Cars
Steel Cafe Observation Cars
Steel Underframe Buffet—Library—Barber—Observation Cars

Due for Shopping every 17 months

Steel Underframe Coaches
Wood Coaches, Class A
Steel Express Cars
Steel Underframe Express Cars
Steel Mail Cars
Steel Mail and Express Cars
Steel Underframe Mail and Express Cars
Steel Passenger and Express
Steel Motor Cars
Steel Underframe Tourists
Steel Underframe Sleepers
Wood Sleepers, Class A
Steel Underframe Observation Sleepers

Due for Shopping every 20 months

Wood Chair Coaches
Wood Coaches (other than class A)
Wood Express
Steel Underframe Refrigerator Express
Wood Mail and Express Cars
Wood Passenger and Express
Wood Diners
Wood Tourist Cars
Steel Official Cars
Steel Underframe Official Cars
Wood Parlor
Wood Cafe-Observation Cars
Wood Sleepers Class B
Wood Sleeper Compartment Cars

Upon arrival at shops cars will be thoroughly inspected, and work necessary classified.

Between shopping, cars will be kept in repair in Coach Yards, and in this regard much can be done by touching up with paint and varnish window sashes, scratched areas and parts becoming exposed to weather conditions on account of absence of paint or varnish. (See para. 13 of Section I.)

Sub-para. (II) CLASSIFICATION OF WORK

There are four classes of repairs to Passenger equipment, known as Running, Light, Medium and Heavy Repairs.

Running Repairs. These repairs consist of only minor repairs such as

light repairs to platforms, draft rigging, trucks or other incidental replacement of material that might be missing.

The car while in shop must be put in a clean sanitary condition. The outside to be washed, windows cleaned, trucks and platforms washed and roof painted.

Inside head linings sponged or wiped dry—upper deck and side walls sponged or wiped, lamps cleaned, floor flushed, all dirt behind steam pipes, coal boxes and stoves removed. Cushions and seat backs dusted and where necessary the floor and steam pipes to be painted. Toilets and hoppers renovated and any other work necessary to put the car in good condition for immediate service.

Light Repairs. These repairs consist of such necessary repairs as is not covered in running repairs and where a car is not held for general overhauling, such as heavy repairs to platforms, draft riggings, trucks, etc.

The car should have the same attention as to cleaning and sanitary condition as is given when receiving running repairs. Special attention being given to painting of floors, steam pipes, varnishing of arm rests and window sills. Painting of trucks, platforms, blackening of irons and hand rails and particularly to the roof and touching up of body if same is bruised or scratched.

Medium Repairs. These repairs consist of the partial stripping of a car when it comes to shop for repainting. Outside sash not to be removed except where damaged or in need of repairs that cannot be made while in the car. Inside sash to be removed where cars are equipped with double sash. Swing sash to be left in frame. End doors, smoking and toilet doors not to be removed unless necessary. Outside recolored or revarnished as needed. Inside all bruised woodwork scraped and refinished. Balance of car to be finished in part and oil rubbed. Head lining repainted if necessary, and finished with a gloss varnish. Floors and steam pipes painted and all other necessary work done. Vestibule refinished. Platforms--trucks--irons under car--hand rails--roof and draft riggings overhauled and painted.

Heavy Repairs. These repairs consist of the complete overhauling of the car. Car to be entirely stripped of all movable fixtures. Outside body of car--paint to be burnt off, if car is of wooden construction and sand-blasted if of steel and car primed, puttied, colored and varnished. The whole interior of car to be renovated, revarnished and oil rubbed. Head lining properly finished. Floor steam pipes and all other interior work to be given first class attention.

Vestibules refinished. Platforms, trucks, irons under car, roof and draft riggings overhauled and painted. Particular attention given to roof, especially on steel cars.

Sub-para. (III) DETAILS OF PASSENGER CAR REPAIRS

Cars are handled for heavy repairs at Milwaukee shops only, and

instructions as to details are unnecessary herein. Points carrying out light passenger car repairs will communicate with Master Car Builder concerning practices, procedure, or any point about which they are in doubt. Rules governing wheels, axles, air brakes and safety appliances will be complied with. The correct blocking of elliptic springs will be adopted. During the war certain materials were not obtainable in sufficient quantities, resulting in many wrong sized leaves being substituted in elliptic springs. Wrong springs were often applied to cars. These practices are to be corrected as cars go through shops.

In handling G. E. Train Lighting turbines, 3,600 and 4,500 R. P. M., it must be borne in mind that *split* thrust washers are not to be used. The use of them results in failures by burning out the center bearing and damaging the bucket wheel and nozzles. Thrust washers are made of steel and bronze. They are placed at either end of the main bearing to center the bucket wheel of turbine. These washers are of such importance that a failure of one will put the equipment out of use. It also requires the dismantling of the turbine to replace one of these "thrust washers." So keep them in stock and do not attempt to make, as the proper material to make them in our shops is not carried in stock.

Increased-size equalizers are to be applied to cars enumerated in M. E. Circular Letter 1001, dated June 3rd, 1921. Blue Print of Standard Equalizer accompanied the circular letter in question.

The Post Office Department has authorized the use of a malleable staple, item D, pattern number 6313 as shown on drawing 15746-C issued with M. E. Circular Letter 1068. Whenever mail or express cars are held for general repairs or new staple have to be applied pattern number 6313 will be used instead of the present forged staple.

Sub-para. (IV) STORING OF CARS OR CAR PARTS

With the approach of winter a number of sleepers, diners, etc., are stored. Before these cars are placed in storage foremen must make certain that the heating and water systems are blown out to prevent freezing and bursting.

Storm sashes are to be removed from passenger cars at their regular terminals between March 15th and April 1st when weather will allow, and shipped as follows: Eastern Lines to Western Avenue, Chicago, and Western Lines to Tacoma.

Screws removed from storm sash should be securely packed and marked, and must be kept with the sash to which they belong.

When quantities of sash are shipped short distances, they must be piled in cars on their edges with glass lengthwise of car and strips nailed securing them so as to prevent breakages. When sash cannot be shipped safely in this way, without liability of breakage, it should be securely crated.

Storm sashes must be repaired at points where they are stored; repairs to be completed not later than September 1st.

Places forwarding sashes will advise receiving points, giving car number

or name from which sashes were removed, date shipped, and how forwarded. Duplicate copy of advice to be sent to the Master Car Builder.

On September 1st terminals will write Tacoma or Chicago, as the case may be, giving names or numbers of cars for which sashes are required. Copy of such letters to be sent to the Master Car Builder.

After forwarding all sashes applied for, Tacoma and Chicago will, as soon after September 1st as practicable, send a list of all storm sashes on hand to the Master Car Builder, who will take up with the Superintendent of Transportation to locate cars concerned, and advise disposition of remaining sashes.

Screens and Deflectors should not be removed from cars, but when not in use stored on the cars to which they belong. When making the monthly inspection of sleepers described in Section I, para. 13 (Inspection and Repair of Passenger Cars in Coach Yards) foremen will at the same time check the screens and deflectors, and when any shortage is found the matter will be reported by letter, and at the same time requisition made for replacement.

Cars going through shops are to be carefully inspected before release, to see that the full complement of screens and deflectors is in the car.

Note. To enable readers to more readily follow the preceding instructions regarding Passenger Car Repairs, a print of a passenger car, showing its various parts, is shown herein.

Para. 6 PREVENTION OF ACCIDENTS

It will be the duty of Car Foremen to take all precautions to guard against the injury of employees.

Much space could be devoted to outlining directions in which action should be taken, but the ground has already been fully covered, and all repair points have information as to what is necessary and Safety First Committees have been appointed all over the railroad. It is more a matter of seeing that instructions are carried out, and this is the first duty of every supervisor.

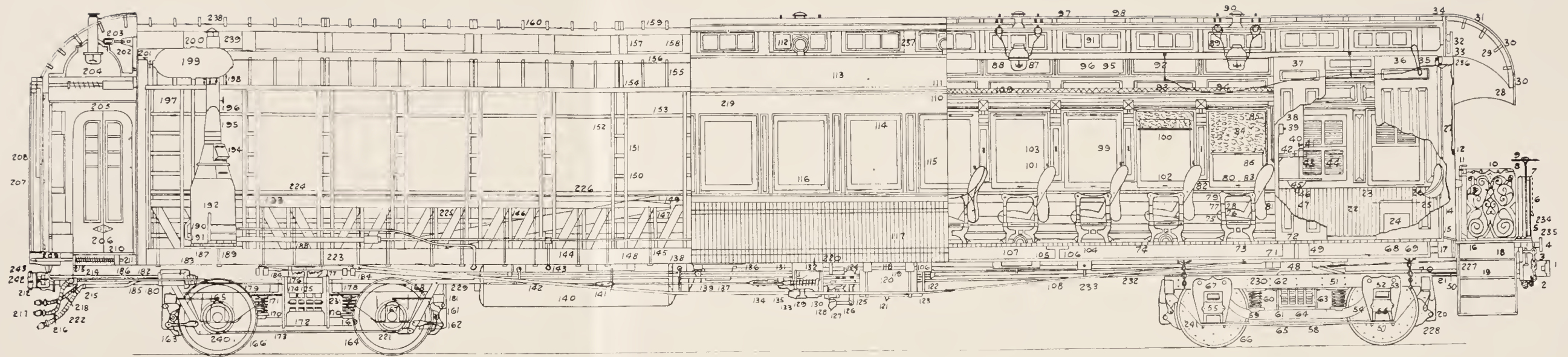
In the past our road has filed more small claims for injured persons than any railroad in the country. As soon as an injured employee is fit to resume work he is to be allowed to return, without waiting to procure a release from the Adjustor General's Department. If the man demands compensation for time lost by reason of the injury, the Foreman will give him a certificate showing days lost account of injury, and rate per day, and send him to the local representative of the Claim Adjuster. When less than a week is lost, claims must be strongly discouraged, other than under unusual circumstances.

First Aid Kits are to be properly maintained at all points at all times, and traveling representatives of this department will check this up on every occasion a place is visited.

Men working around machinery are not to wear gloves. Periodically a man is badly injured or killed on account of neglecting to follow this rule, and there is an outcry. Foremen will take strong action and insist on men exercising the necessary care, and not await an accident to demonstrate the wisdom of the rule.

In this connection all men should be warned not to throw pieces of iron, wood, tin cans, or any other article into other than specially designated cars. Apart from the damage resulting to stokers account these articles getting into coal, there is the liability of accident resulting in injury to firemen or engineers.

CHICAGO MILWAUKEE & ST PAUL RAILROAD PASSENGER CAR CHART.



1 TANNY COUPLER
2 SAFETY CHAIN
3 BRAKE CHAIN
4 BUMP BUFFER
5 PLATFORM RAILING
6 PLATFORM RAILING CHAIN
7 PLATFORM RAILS
8 BRAKE SHAFT
9 BRAKE WHEEL
10 PLATFORM GATE
11 GATE LOCK HANDLE
12 BELL CORD COUPLING
13 PLATFORM GATE HINGE
14 BODY HAND RAIL
15 THRESHOLD PLATE
16 PLATFORM
17 END SILL
18 STEP RISER
19 STEP
20 BRAKE SAFETY STRAP
21 BRAKE CHAIN CONN ROD
22 WAINSCOT PANEL
23 WAINSCOT PANEL RAIL
24 CLOSET HOPPER
25 URINAL PIPE
26 URINAL
27 CORNER POST
28 PLATFORM HOOD BOW
29 PLATFORM HOOD CARLINE
30 PLATFORM ROOF

31 PLATFORM HOOD CEILING
32 END RITE
33 DECK END SILL
34 END CARLINE
35 CAR SIGNAL VALVE
36 DECK SASH OPENER
37 PARTITION
38 WATER COOLER
39 CUT OFF VALVE
40 WATER COOLER FAUCET
41 TUMBLER
42 TUMBLER HOLDER
43 WATER COOLER SUPPORT
44 WINDOW BLIND
45 BASIN WASHBOWL
46 BASIN COUPLING
47 WASHBOWL PIPE
48 SIDE BEARING
49 BODY BOLSTER
50 MAIN TRAIN PIPE
51 EQUALIZER SPRING CAP
52 PEDESTAL JAW
53 PEDESTAL HORN
54 JOURNAL BOX COVER SPRING
55 JOURNAL BOX LID
56 AXLE BOX
57 PEDESTAL JAW BIT
58 PEDESTAL TIE BAR
59 EQUALIZER SPRING SEAT
60 EQUALIZER SPRING

61 SPRING BANK
62 TRUCK SIDE FRAME
63 SPRING BAND
64 EQUALIZER
65 CAR TRUCK
66 WHEEL FLANGE
67 PEDESTAL
68 CHECK CHAIN
69 CHECK CHAIN EYE
70 CHECK CHAIN HOOK
71 TRUSS ROD ANCHOR IRON
72 FLOORING
73 SEAT LEG
74 FOOT REST
75 SEAT BOTTOM
76 CUSHION CAR SEAT
77 SEAT END
78 SEAT LOCK
79 SEAT ARM
80 SEAT ARM PLATE
81 SEAT BACK BAND
82 SEAT BACK
83 INSIDE WINDOW SILL
84 SHADE
85 CONDUCTOR'S VALVE
86 DISCHARGE PIPE
87 GLOBE
88 GAS BURNER
89 LAMP ARMS
90 LAMP VENT

91 CLEARSTORY
92 BELL CORD HANGER
93 BELL CORD HANGER RING
94 BELL CORD
95 CAR MOULDING
96 CEILING
97 ROOF BOARDS
98 ROOF
99 SASH
100 ADJUSTABLE SHADE HOLDER
101 WINDOW LOCK
102 SASH LIFT
103 MATCH STRIKER
104 STEAM PIPE COVER
105 FLOOR TIMBER DISTANCE BLOCK
106 CROSS-TIE TIMBER
107 SIDE SILL
108 TRUSS ROD
109 BASKET RACK
110 BASKET RACK NETTING
111 BASKET RACK ROD
112 TORPEDO VENTILATOR
113 LOWER DECK
114 WINDOW LINTEL
115 WINDOW PANEL
116 OUTSIDE WINDOW SILL
117 OUTSIDE PANEL
118 AUXILIARY RESERVOIR BEAMS
119 AUXILIARY RESERVOIR BANDS
120 AUXILIARY RESERVOIR

121 AUXILIARY RESERVOIR DRAIN COCK
122 BODY TRUSS ROD BEARING STANT
123 TRUSS ROD BEARING
124 AUXILIARY RESERVOIR NIPPLE
125 CYLINDER LEVER
126 TRIPLE VALVE BRANCH PIPE
127 DRAIN CUP
128 TRIPLE VALVE
129 TURNBUCKLE
130 BLEEDING VALVE
131 BRAKE CYLINDER
132 PISTON PACKING LEATHER
133 RELEASE SPRING
134 CROSS HEAD
135 BACK CYLINDER HEAD
136 GAS PIPE FROM GOVERNOR
137 PINTSCH GAS GOVERNOR
138 PINTSCH GAS GAUGE
139 GAS PIPE TO GOVERNOR
140 PINTSCH COMPRESSED GAS TANK
141 FLOATING LEVER
142 TRAIN SIGNAL PIPE
143 TRAIN BRAKE PIPE
144 BODY BRACE STRAINING RODS
145 COMPRESSION BEAM BRACE
146 BODY BRACE
147 PANEL RAIL
148 STEAM HEATING PIPE
149 COMPRESSION BEAM
150 WINDOW POST

151 WINDOW PANEL FURRING
152 SILL AND TRATE ROD
153 UPPER BELT RAIL
154 RITE
155 MAIN CARLINE
156 DECK SILL
157 DECK POST
158 DECK SASH
159 DECK PLATE
160 LOWER DECK CARLINE
161 BRAKE BLOCK
162 BRAKE BEAM
163 BRAKE BEAM KING POST
164 CAR WHEEL
165 AXLE SAFETY BEARING
166 BACK FACE PLATE
167 AXLE
168 AXLE SAFETY BEARING THIMBLES
169 AXLE SAFETY BEARING
170 SPRING PLANK HANGER
171 BOLSTER SPRINGS
172 LOWER SPRING HANGER PINOT
173 LOWER BRAKE ROD
174 BOLSTER SPRING CAP
175 TRUCK BOLSTER
176 CENTRE PIN
177 TRUCK CENTRE PLATE
178 SAFETY BEAMS
179 BRAKE ROD
180 BRAKE LEVER
181 END PIECE OF TRUCK FRAME

182 COMBINATION SIDE SPRING
183 SIDE STEM
184 TWIN BODY BOLSTER
185 SHANK END OF DRAWBAR
186 DRAFT TIMBERS
187 BOTTOM STOVE PLATE
188 STEAM PIPE TACRET
189 ASH PIT DOOR
190 ASH PIT DOOR HANDLE
191 ASH PIT
192 BAKER HEATER
193 LOWER BELT RAIL
194 BAKER HEATER COAL HOPPER
195 STOVE PIPE
196 STOVE PIPE DAMPER
197 CIRCULATING PIPES
198 CIRCULATING DRUM WATER GAUGE
199 CIRCULATING DRUM
200 SAFETY VENT FOR BAKERS HEATER
201 FILLING FLANGE FOR " "
202 VESTIBULE EQUALIZER
203 " " CHAIN
204 VESTIBULE LAMP
205 VESTIBULE
206 VESTIBULE DOORS
207 CURTAIN
208 VESTIBULE FACE PLATE
209 PLATFORM END SILL
210 PLATFORM BANK
211 PLATFORM SHORT SILLS

212 COUPLER
213 COUPLING VALVE
214 COUPLING VALVE HANDLE
215 ANGLE FITTINGS
216 AIR BRAKE HOSE
217 COUPLER
218 STEAM HOSE
219 LETTER BOARD
220 AIR BRAKE PISTON
221 AXLE SAFETY STRAP
222 SIGNAL HOSE
223 BODY COUNTER PLATE
224 BODY COUNTER BRACE
225 BRACE STRAINING ROD
226 BRACE
227 BRAKE SHAFT CHAIN
228 BRAKE SHOE
229 DEAD LEVER
230 EQUALIZER SPRING CAP
231 EQUALIZER SPRING FLITCH RATES
232 DECKENING FLOORING
233 INTERMEDIATE CROSS-TIE TIMBER
234 PLATFORM RAILING POST
235 BASE WASHER
236 DOOR LINTEL
237 CLEARSTORY POST
238 STOVE PIPE CAP
239 STOVE PIPE
240 AXLE JOURNAL
241 JOURNAL BOX COVER BOLT
242 KNUCKLE PIN
243 VESTIBULE BUFFER PLATE.

Section III

MATERIALS

Para. 1

GENERAL REVIEW

To the Car Foreman the material situation must at times appear most confusing. The purchasing of millions of dollars worth of material annually, in the form of innumerable articles ever changing in character and fluctuating in prices, is attended with many difficulties not apparent to those outside of the immediate circle of responsibility.

It is realized that losses result from not providing material, but the problem is to keep expenditures for requirements within certain defined limits. This often cramps and hampers our operations, but this is taken into consideration when fixing the amount to be spent on Stores. Our efforts must be utilized to combat this disadvantage.

There are two methods which can be employed to this end, viz: Co-operation and Standardization.

Para. 2 CO-OPERATION WITH STORE DEPARTMENT

Sub-Para. (I)

NECESSITY

To successfully handle the undertaking of repairing or building cars, three things are required—men, material, and facilities. Two of these factors are within our control, but the third is not, but it is quite essential to our operations, and the necessity for co-operation with the department controlling the supply of materials is therefore very great.

While it is true that the quantities of materials to be purchased in given periods are often limited, and difficulty in obtaining supplies will be encountered, this does not mean that it can be accepted as a reason for not meeting demands made upon us for cars. The responsibility for producing equipment to handle the business offering is ours, and regardless of obstacles we must find means of keeping cars in service. With this in view local storekeepers should be shown in a practical manner on the spot what is involved, so they may present the case in its proper light to their own department.

Sub-para. (II)

METHOD

Storekeepers at all points should know what Car Department is doing, and the Car Foreman must know how his material requirements are being taken care of. To permit this state of affairs to pertain—and until it does no point can hope to operate successfully—the Car Foreman should have regular sessions with the Storekeeper, and when practicable Repair Tracks should be gone over together, so that the work on hand may be discussed, and future plans, especially those involving increased or decreased output, changes of material requirements, etc., made known.

At least once a week the Car Foreman should go over the stocks of material on hand with the Storekeeper, and where it is observed any items are getting low it must be ascertained what the position is—whether enroute,

or when ordered, and the matter then followed up until the situation is eased.

Care must be exercised to see that orders are not placed by the Storekeeper on the basis of numbers used as shown by books, resulting in articles being ordered in excess of quantities required. The book records are for guidance only, and the Car Foreman should look over all regular requisitions before they are sent in, to guard against the possibility of excess quantities being ordered. Excess quantities form as great an evil as shortages, as an overstock at one point means either a shortage of the same article at another, or the inability of Store Department to furnish other necessary items on account of amount of money allowed them being used in purchasing these excesses.

Para. 3. STANDARDIZATION

Sub-para. (I) ITS MEANING

Standardization of Material means minimizing quantities to be carried in stock, simplification of repair work, and reduction of work of ordering, obtaining and handling material. Our big aim is to standardize every possible article used in connection with the repair or construction of cars, in so far as can usefully be accomplished. The principle should be applied locally, so that parts will be interchangeable, and the minimum of spares will be necessary.

Suggestions for standardization are to be encouraged. When a carman or inspector offers a suggestion it should be forwarded through the correct channels to the Master Car Builder, and the name of the person responsible for the suggestion included. In rejecting impracticable suggestions it must be done in a spirit that will not tend to discourage other ideas, as many of the best appliances in operation today have emanated from the brains of men on the tracks, and a man must be given credit for offering an idea, even if it is not accepted.

Sub-para. (II) ARTICLES STANDARD TO CAR DEPARTMENT

The following articles have been made standard to our department:

Spring Planks. Our standard spring plank for system freight equipment will have a vertical flange extending from end to end, without any provision for roller seats.

Flooring. The following flooring will be used on cars of Company ownership (only). (On foreign cars use flooring standard to car.)

- Style No. 1 1¾" Shiplapped Flooring on coal and gondola cars, both wooden and steel underframe. Automobile, Refrigerator, Box, Furniture and all other House Cars.
- Style No. 2 2¼" Shiplapped Flooring. On steel underframe flat cars and steel framed gondola cars 303,200 to 305,499.
- Style No. 3 1¾" Butt Edge Flooring. (a) On wooden underframe flat cars and water cars this flooring to be used with a 1" open space between floorings. (b) On stock cars with no open space provided between floorings.

Strainers for Type L Triple & Distributing Valves. The strainer formerly used under the safety valve of the type "L" Triple Valves and Distributing Valves, Westinghouse piece No. 16214, is no longer manufactured, and piece No. 1751 which has been used elsewhere on brake equipment prior to this time, will be substituted.

Hereafter when ordering strainers used under the safety valve of the type "L" triple valves and distributing valves, specify piece No. 1751.

Brake Hangers. It is very important that brake hangers do not fail in service, and all brake hangers are to be of material and manufactured in accordance with Specification No. 521-A, obtainable upon application.

High Speed Steel. On account of its extreme toughness and hardening range as well as the simple treatment necessary, Steel for Rivet Busters will be Ludlum Steel, Seminole brand. Specify accordingly on requisitions.

Journal Box Lids. "Asco" pressed steel journal box lids are standard to our line, and will be used for repairs for both freight and passenger equipment. In making repairs to foreign freight cars it should be noted that it is necessary to show the name of the lid and the size of the journal in order to permit of correct A. R. A. billing.

Pin Lifters or Uncoupling Levers. For all new system equipment (built since January 1st, 1922) or for system cars undergoing very heavy repairs all freight equipment employing a coupler with the overhead type of pin lifter, the standard uncoupling lever and link will be made in accordance with the sketch circulated with M. E. Circular Letter 1079. This uncoupling rigging will be furnished complete from Milwaukee or Tacoma Shops.

Electric Extension Light Cord. It has been definitely established that the Okoloom extension cord will last considerably longer than the Theatre cord now used, and while the initial cost is greater, still the cost of maintenance and application of sockets and plugs will be considerably less, so that the ultimate cost will favor the Okoloom cord. Hereafter the Okoloom cord or equivalent construction will be generally adopted for this purpose.

Journal Bearing Wedges. In order to comply with A. R. A. Standards and to secure greater economy in maintenance, all journal bearing wedges will hereafter be furnished of material as indicated below:

- 4 $\frac{1}{4}$ " x 8" Malleable Iron or Cast Steel
- 5" x 9" Malleable Iron, Forged or Cast Steel
- 5 $\frac{1}{2}$ " x 10" Forged or Cast Steel.
- 6" x 11" Forged or Cast Steel

Skeleton back journal wedges of all sizes are strictly prohibited.

Wedges for journals which do not comply to A. R. A. Standards will be maintained according to previous standards.

Painting Materials. The following materials to be used in conjunction with the painting of passenger train cars, freight train cars, locomotives and tenders, are standard, and will be furnished on regular storekeepers' requisitions from stock on hand at the mixing room, Milwaukee shops:

	No.
<i>Primers</i>	1—1st Primer in Oil—Paste. 2—2nd Primer in Oil—Paste. 3—Acme Metal Body Primer for Steel Pass. and Loco. 4—Filler in Paste (lead color). (All paste to be reduced with our standard liquid.)
<i>Body Colors</i>	5—Standard Yellow Body Color—Paste. 6—Standard Roof Paint—Paste. 7—Flat Truck Color—Paste. 8—Acme Metal Body Surfacer for Steel Pass. and Loco. 9—Acme Metal Body Filler (lead color) for Steel Pass. and Loco. 10—Baggage Ceiling Color No. 104 (white). 11—Ceiling Color for Coaches (dark cream). 12—Ceiling Color for Dinners, Sleepers, and Observation Cars (light cream). 13—Caboose Ceiling Color (light cream). 14—Baggage Side Wall Color No. 105 (buff). 15—Caboose Wall Color (drab). 16—Red Sign Board Color (1st, and 2nd coat). 17—Front End Paint for Passenger Engines. 18—Front End Paint for Freight Engines. 19—"One Coat" Freight Car Paint (red). 20—Freight Car Paint No. 5 (red). 21—Mineral Paint No. 25. 22—Acme "One Coat" Caboose Red.
<i>Tinting Colors</i>	23—Burnt Sienna in Japan. 24—Raw Sienna in Japan. 25—Burnt Umber in Japan. 26—Raw Umber in Japan. 27—Chrome Yellows in Japan. 28—Van Dyke Brown. 29—Drop Black.
<i>Blacks</i>	30—Iron Black. 31—Finishing Black.
<i>Varnishes</i>	32—Engine Finishing Black. 33—Murphy Outside Wearing Body Varnish. 34—Flood & Conklin Outside Finishing Varnish. 35—Valentine Valspar Outside Varnish. 36—Chicago Varnish Company's Outside Rubbing Varnish. 37—Murphy TWF Interior Varnish. 38—Semi-Gloss Interior Varnish. 39—Engine Finishing Varnish. 40—Mixing Varnish. 41—Freight Varnish. 42—Thresher Body Varnish. 43—Pratt and Lambert Interior Varnish. 44—Cooks Light Ceiling Varnish.
<i>Enamels</i>	45—Truck Enamel. 46—Pratt & Lambert Vitrolite Enamel. 47—Standard Lettering Enamel. 48—Sash Enamel for Enameled Cars. 49—Cab Green Enamel. 50—White Enamel. 51—Cream Enamel.
<i>Oils,</i>	52—Lithargen Lead.
<i>Turpentines,</i>	53—White Lead.
<i>Leads, Etc.</i>	54—Red Lead. 55—Sublimed Lead (for stencilling freight cars). 56—Boiled Linseed Oil. 57—Raw Linseed Oil. 58—Sipes Japan Oil. 59—Sipes Enamel Oil.

- 60—Turpentine.
- 61—Masury Perfection Drier.
- 62—French Zinc.
- 63—Wood Filler.
- 64—Freight Japan.
- 65—Japan Gold-size.
- 66—Gold Leaf.
- 67—Aluminum Bronze.
- 68—Aluminum Leaf.
- 69—Hard Drying Putty (for wood).
- 70—Acme Putty (for Iron & Steel).
- 71—Oil Putty.

Putties

Section IV

STANDARD PRACTICES

Para. 1 ADVANTAGES

A standard method of carrying out any work has many advantages. The method is arrived at as the result of the study and experiences of many instead of the individual, and for this reason is generally the best from a mechanical point of view. It is invariably accepted as standard because of its economy, and the result of uniform methods permits of the transfer of Foremen and carmen without undue difficulty, while the absence of variation in cars greatly simplifies their subsequent handling. Standard Practices should be carefully followed by all points, and any methods of handling work found to be beneficial to the Department should be reported as a suggestion for adoption as a Standard Practice.

Para. 2 FREIGHT CAR STANDARD PRACTICES

Sub-para. (I) COUPLERS

In fitting up couplers in freight equipment cars it should be arranged to have one and one-quarter inches clearance each side, that is, between outside face of shank and inside face of draft sill, also clearance between top of shank and under side opening in end sill to be $\frac{3}{4}$ of an inch.

Our standard practice for new car equipment and new couplers is to use $1\frac{1}{4}$ inch diameter rivets. However, there are a number of couplers now fitted with $1\frac{1}{8}$ inch diameter rivets, and when requiring repairs at shops where these couplers can be reamed out to take the standard size this should be done. At shops where no facilities obtain to change couplers to take the larger sized rivet, it will be admissible to apply the smaller size.

Coupler yoke rivets should be headed on opposite sides; that is, one rivet will be headed on one side of the yoke and the other rivet will be headed on the opposite side of yoke.

Coupler yokes are to be gibbed wherever possible to neatly fit the end of the draw bar butt and thus relieve the rivets of as much shearing strain as possible.

Coupler carry irons must be held in place by at least four bolts if placed vertically and one bolt through necessary casting if placed horizontally, all securely fastened in place. On wooden draft timber system cars, coupler carriers are to be gibbed or turned up on the ends to avoid draft sills splitting or breaking away.

Cotter keys are not to be applied to knuckle pins of couplers on cars other than hopper and fixed end gondolas.

Cars equipped with 5"x7" shank couplers having M. C. B. temporary standard extended head, may, when being renewed, be replaced by A. R. A. type "D" coupler having 5"x7" shank. The only difference involved is that the type "D" has a 12" head, whereas the M. C. B. temporary standard has a 12 $\frac{1}{4}$ ", but end ladder clearance (12") can readily be maintained. (This change does *not* apply to 5"x5" shank couplers, as the substitution in this case would not be practicable.)

When type "D" coupler is applied, stencilling of car is to be changed accordingly.

Sub-para. (II) UNCOUPLING LEVERS

Uncoupling levers for cars employing underneath uncoupling rigging will be provided with handle 5" in length only, as shown in M. E. Circular Letter 1011. Incidentally these levers are to be within 6" of side of car when applied. Uncoupling levers for cars employing top lift rigging are to be applied on new or rebuilt cars as per standard laid down in Section covering "Materials."

Sub-para. (III) DRAFT TIMBERS

Draft timber bolts 1 $\frac{1}{8}$ " diameter must be applied to all cars having draft timbers, center sills or draft rigging applied. $\frac{7}{8}$ " diameter bolts will be removed from empty cars on all repair tracks, whether draft timber or draft rigging is renewed or not.

When applying new center sills, one keyway only must be cut in sill, omitting keyway nearest to end sill. When applying new draft timbers, one keyway only must be cut in timber; the keyway in center sill corresponding to the keyway omitted in draft timber and should be filled with a piece of wood nailed in place.

Draft timbers are to be framed and bear against the inside face of end sill. The use of fillers between bottom of center sill and top of draft timber will not be allowed.

Sub-para. (IV) AIR BRAKES

As cars pass over repair tracks they are to be examined and those having dirt collectors stencilled as shown on Blue Print D-616 accompanying M. E. Circular Letter 1009.

**Sub-para. (V) TRIPLE VALVES ON NON-REVENUE
CARS**

Style F-36 triple valves are to be applied to non-revenue cars, and where K-1's are found they will be replaced accordingly.

Sub-para. (VI) HANDBRAKES

Hand brake chains are to be fixed to brake staff drums in the manner shown on Blue Print accompanying M. E. Circular Letter 1009.

Sub-para. (VII) OFFSET GRABS

The Safety Appliance law does not require offset grab irons, such as are used for the bottom tread of ladders, to be any larger than other grabs, which are a minimum of $\frac{5}{8}$ ". It has been found, however, that due to the offset or foot guard allowing a greater leverage, the grab iron becomes bent, which interferes with the minimum 2" clearance required. It has therefore been found that a heavier grab iron is necessary in order to maintain the required clearance, and this is the reason our standard calls for a $\frac{3}{4}$ " grab where offset is required.

Sub-para. (VIII) DOOR LOCKS

When applying or renewing door locks on system box, refrigerator and other house cars, burglar-proof locks are to be applied.

Sub-para. (IX) STEEL SPRING PLANKS

Steel spring planks to be used for renewals on system cars will have a vertical flange extending from end to end, and no provision will be made for roller seats. The space between the top of the spring plank and the lower surface of the top spring seat is to be filled in with an oak block, as shown in sketch accompanying M. E. Circular Letter 1014.

Sub-para. (X) WOODEN SPRING PLANKS

When wooden spring planks are used they should be of White Oak—not of fir.

Sub-para. (XI) REMOVAL OF BARBER ROLLERS

On system cars having Bettendorf trucks the Barber rollers are to be removed and wooden blocks inserted in their place. This refers, however, only to such rollers as are located between the springs and the spring plank. Where the rollers are placed above the springs, as on our later type it is not intended that such rollers be removed.

**Sub-para. (XII) REMOVAL OF SIDE SHEATHING
(SCHEDULE 5 WORK)**

In the application of the butterfly ends to Schedule No. 5 Cars, the cost can be materially lessened by observing the following instructions in removing old body bolsters. Instead of removing four or five boards of sheathing and cutting out a piece of the side nailing sill in order to get the rivets which secure bolster to the side sill Z bar, it should be arranged to bore holes through the sheathing and nailing sill, of sufficient diameter to permit drifting the rivets out through the holes, and also applying new rivets in same manner. After the work has been completed, the holes are to be plugged in a workmanlike manner, and should be toe-nailed to prevent possibility of working out.

Sub-para. (XIII) ROOFS

In order to obtain uniformity the following will be observed in the handling of roofs of system cars.

On all freight cars held for repairs the roofs must be inspected and placed in good condition.

If roofs are of the inside metal type, and boards are loose, all loose nails must be drawn and boards renailed with two nails, staggered in each board at each side plate, purline and ridge pole. In renailing care must be taken to use proper sized nails, so that the metal roofing will not be punctured, correct size being $2\frac{1}{4}$ " No. 2 barbed wire. If the boards require renewal, tongue and groove boards $5\frac{1}{4}$ " wide should be used.

If the inside metal sheets must be renewed, replace with a standard double board plastic roof, including facia and ridge pole. Any metal sheets thus reclaimed will be used in repairs to other metal roofs, flashing, etc.

All nail holes left open after renailing are to be carefully and properly filled with "Baco," "Sarco," solder, or other suitable ingredient to prevent leakage.

If roof is of the outside metal type, and only part of metal sheets, are in need of replacement, these sheets are to be renewed in kind.

If practically all of the metal sheets require renewing, standard double board plastic roof should be applied, reclaiming usable metal sheets for piecing out other metal roofs. If the lower course can be patched out cheaply, this should be done. The roof to be cleaned off properly and freed from all protruding nails, etc., after which the plastic roofing paper should be laid down and a course of $5\frac{1}{4}$ " tongue and groove boards applied and allowed to project $1\frac{1}{4}$ " beyond the edge of the facia.

If, however, the lower course of boards cannot be repaired, they should be removed and a standard double board plastic roof applied.

In the application of the double board plastic roof the carlines should be properly notched to allow the ridge pole and purlines to recess into same to such an extent that the top faces will be flush.

Carlines to be secured to side plates with $\frac{3}{8}$ "x4" lag screws.

Purlines secured to carline with two 3" No. 7 barb wire nails at each carline.

Ridge pole secured to carlines with $\frac{1}{2}$ " bolts at each carline with washer and lock nut inside, and these nuts to be gone over and tightened each time car is on repair track. Where suitable means are not available for holding the nuts in place, either through lacking of material or nature of repairs, cut the threads of bolts with chisel to prevent nuts coming off.

The boards to be used are the standard $5\frac{1}{4}$ " tongue and groove, the lower course nailed with 2" No. 8 nails, two at ridge pole, two at each purline, and two in every other board at side plate and facia, one nail being used in alternate boards.

Paper to be laid $\frac{1}{2}$ " from edge of roof and to lap over center at least 6", tacking in place along edges with just sufficient nails to hold. If paper is

not long enough to lap 6" at center, same to be brought up to center and a 12" strip of paper used to cover the joint, lapping 6" each side of center.

Upper course boards standard 5 $\frac{1}{4}$ " tongue and groove, nailed with 3" No. 7 nails, two at ridge pole, two at side plate, and two at facia. Two 2 $\frac{1}{2}$ " No. 8 nails used at each purline.

Outside of roof at center to be covered with 1 X tin or other suitable metal at least 8" wide and nailed with 1" tinners nails spaced about 4" apart.

Running board saddles to be secured with $\frac{1}{2}$ " bolts on metal roofs and with four 3 $\frac{1}{2}$ " No. 16 wood screws on wood roofs. Running boards secured to saddles with 2 $\frac{1}{2}$ " No. 16 wood screws, three to each outside board and two at center boards.

Facia 13 $\frac{3}{4}$ "x5" secured with 4" No. 6 spikes, staggered and spaced about 12" apart.

Tie rods $\frac{5}{8}$ " diameter, eight per car, located 5 $\frac{1}{2}$ " above bottom of carline, and to run through facia using washer and lock nut outside, and each time car arrives on repair track these nuts to be gone over and tightened.

The projection of roof over facia must be 1 $\frac{1}{4}$ " it having been noticed that where a greater projection is used that same has exceeded the clearance and interfered with doorways and overhead structures at industrial plants.

Lower course to be given one coat of standard roofing paint, upper course to be given two coats on top, but none underneath.

"Baco" or "Sarco" should be used on top of boards under outside metal roofs; to fill up holes or cracks after renailing inside metal and lower course of double board plastic roofs, to fill up shrinkage cracks or warping of top course of double board roofs, and around ridge pole bolts on all roofs.

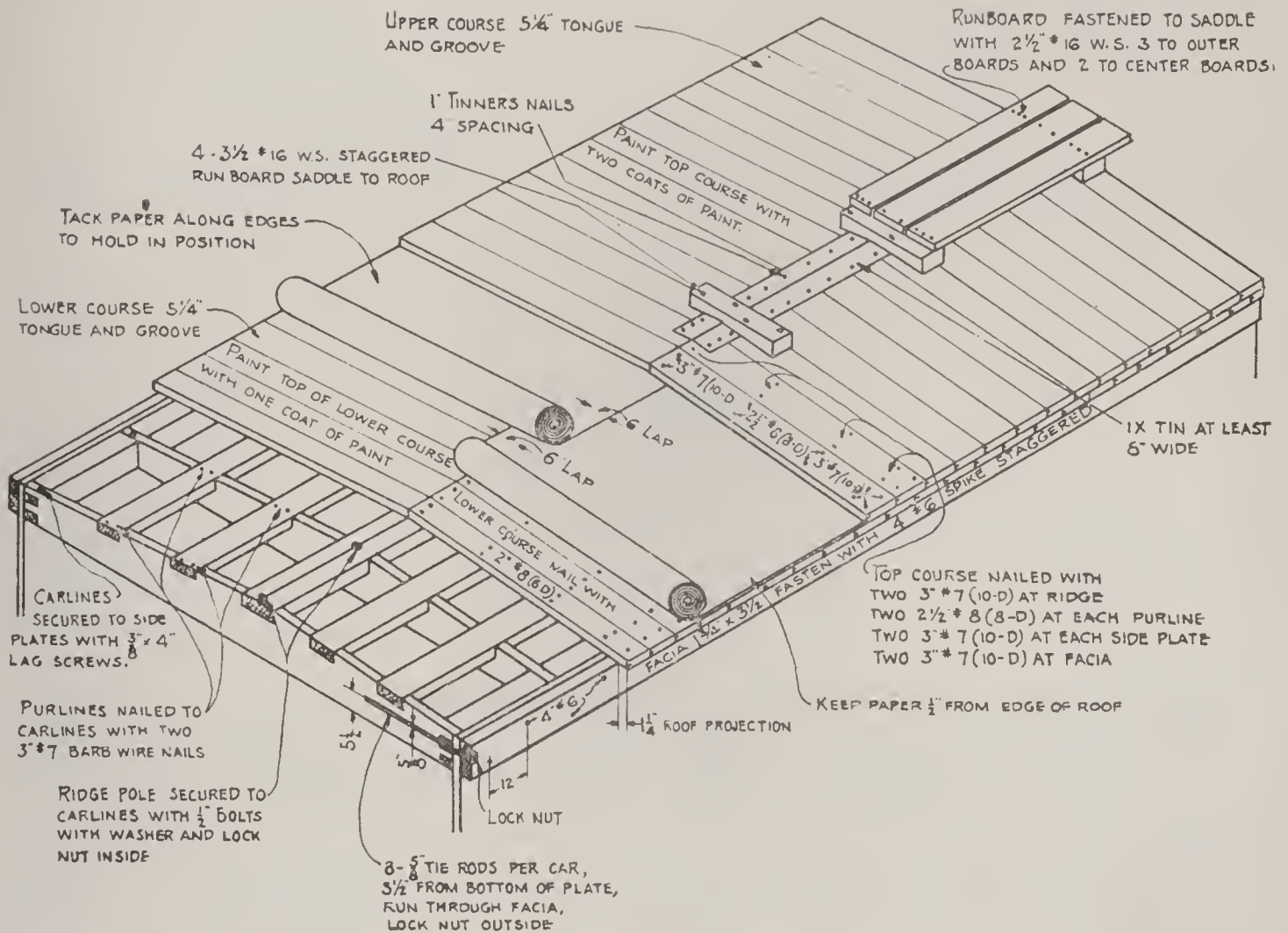
Different methods have been resorted to in bracing roofs and in order that some uniformity be established the type of bracing as shown on print No. 20526-C should be used as far as possible.

It was formerly the practice to use an angle to support and tie the ridge pole to end plate, but in case of end working out this usually destroyed ridge pole, and in place of this angle a sheathing strip should be used as per print No. D-442.

Safety Appliance Law requires that "the ends of running board shall be not less than 6" or more than 10" from a vertical place parallel with end of car and passing through inside face of knuckle when closed with coupler horn against buffer block or end sill, and if more than 4" from edge of roof of car shall be securely supported their full width by substantial metal braces." The need for a metal brace is decided by the length of projection beyond the last running board saddle, and not by the distance running board extends beyond the end of car. It will therefore be our practice to

keep the roof saddles nearest ends of cars as far out as possible, thus shortening the leverage and reducing the risk of end of running board breaking.

Method of applying standard plastic roof is shown in the following sketch:



Sub-para. (XIV) LETTER BOARDS ON STOCK CARS

Letter boards on stock cars are to be 12" wide. One or two boards may be used to obtain the necessary width, and application will be made in accordance with sketch accompanying M. E. Circular Letter 1028.

Sub-para. (XV) SIDE DOOR POSTS FOR STOCK CARS

Only oak is to be used for these side door posts on system stock cars.

Sub-para. (XVI) STANDARD REPAIRS TO MATHER STOCK CARS

We have approximately 400 of these cars, leased, lettered C. M. & ST. P., in series 89,000. Unless repairs standard to the cars are made, the owners correct them upon return of car to Chicago, and bill us. A small stock of Mather Carlton draft gears, with which these cars are equipped, is carried by the General Storekeeper, and when required by any point the local storekeeper will be requested to order rush from Milwaukee.

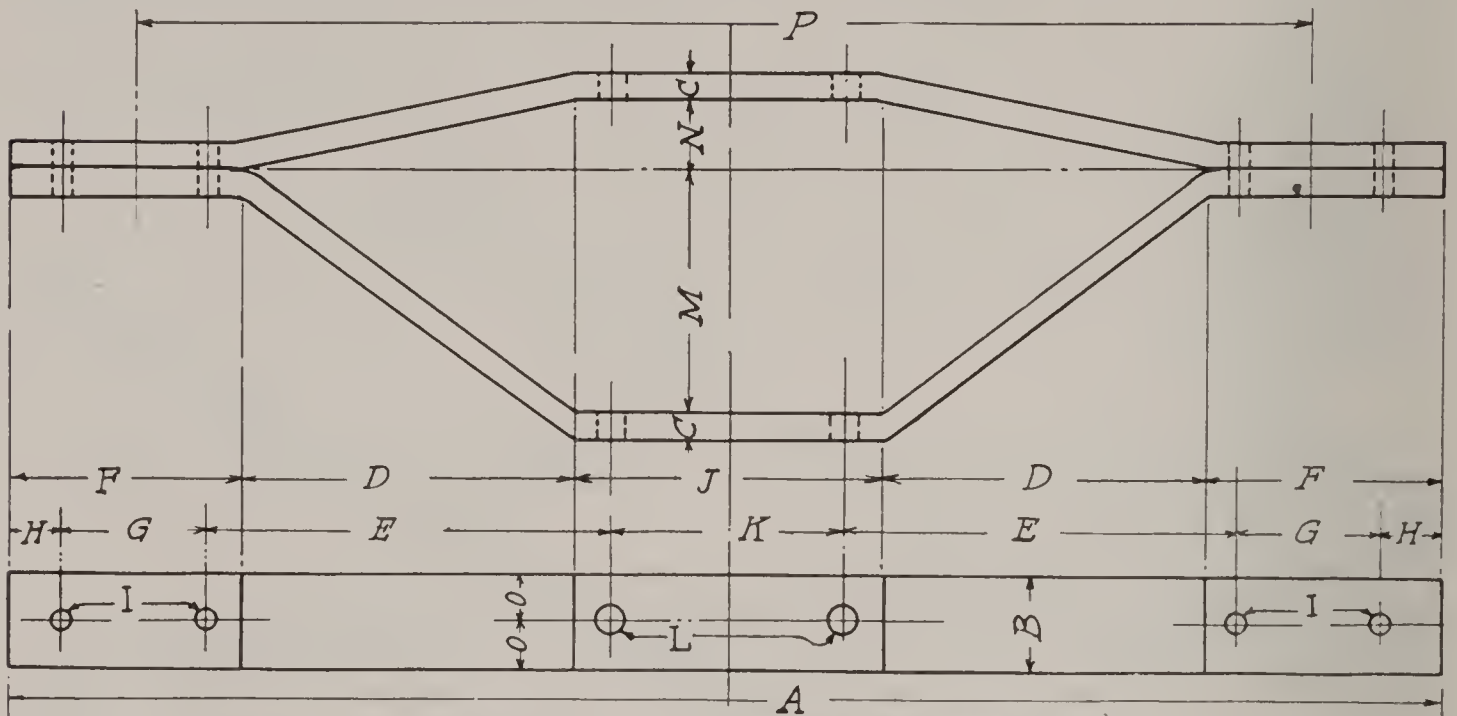
Sub-para. (XVII) MANUFACTURE OF STOCK CAR DOORS

In making stock car doors, the slats are to be nailed—not bolted—to frame of door.

Sub-para. (XVIII) ORDERING ARCH BARS

When ordering arch bars, as is sometimes necessary at points where blacksmith facilities are inadequate, the symbols shown in the following sketch are to be used.

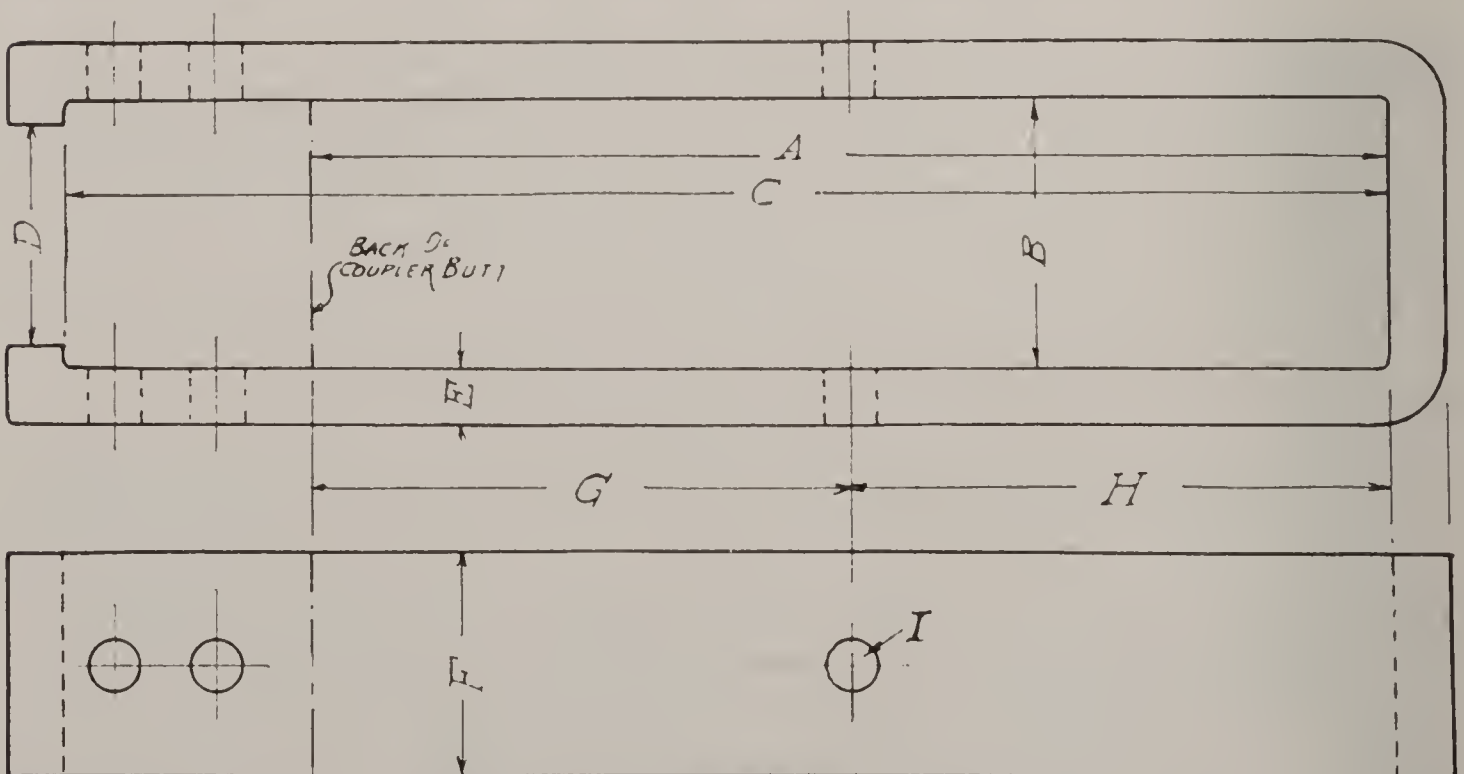
Give dimensions for each symbol. For example—A-72" or B-5", etc.



Sub-para. (XIX) ORDERING COUPLER POCKETS

Whenever it is necessary to order coupler pockets, as is frequently the case at outlying points, the symbols shown in the following sketch will be used:

State dimensions for each symbol. For example—A-24", B-9½", etc. When no space block is used, dimensions G, H, and I are omitted.



Sub-para. (XX) STANDARD MARKINGS FOR FREIGHT CARS

In stencilling system freight cars the same practice must be followed

as regards location, style and size of letters and figures. Standard No. 5 red paint should be applied (new work 2 coats) and sublime lead used for stencilling. Stencil diagrams for different classes of cars are available upon application, as follows:

For Flat Cars,	19358-F
For Refrigerator Cars,	20381-C
For Stock Cars,	19972-C
For Box Cars,	20745-C
For Box Cars,	20637-C
For Gondola Cars,	18892-F
For Additional Stencilling,	D1616

Style and Type of Letters and Figures 2634.

This applies to Southeastern equipment with the exception that the letters "C. T. H. & S. E." will replace "C. M. & ST. P."

Sub-para. (XXI) PAINTING FREIGHT CARS

In addition to painting both surfaces with new wood or iron parts are applied during the construction or repairing of any cars, the following will govern in the painting of freight cars:

Box cars, composite. When new cars are built they are to be given two coats of No. 5 standard freight car paint, allowing 24 hours between coats to dry. This refers to car body, roof, trucks and steel underframes. Stencilling will be done in accordance with standard practice.

When cars are repaired, newly applied parts (excepting corner bands, grabs, etc.) will be given two coats of paint. This can be done without delaying car by painting all sheathing, etc., in advance, so that when applied only one coat of paint need be added. When any appreciable amount of repairing of sheathing and roofing is done, car should be given one complete coat of "one coat" freight car paint, in addition to a former coat of No. 5 standard freight car paint on newly applied parts. Trucks will not be painted unless repaired.

Box Cars, All Steel. New cars are to be painted with one coat of No. 25 paint, followed not less than 24 hours later with one coat of No. 5 standard freight car paint. All steel box cars requiring repainting, or ends repainted, will first be sandblasted, and then painted as laid down for new cars. Trucks will not be repainted unless repaired, but if done two coats of No. 5 standard freight car paint will be given them.

Gondolas, composite. New cars will be given two coats of No. 5 standard paint, including trucks and steel underframe.

Repaired cars will be handled as laid down for repaired composite box cars.

Gondolas, All Steel. When built two coats will be applied, one of No. 25 paint and one of No. 5, with 24 hours between for drying.

When repaired, newly applied parts will be painted with one coat of

No. 5 paint. If car has to be repainted entirely, sandblast and handle as new car. It is no use applying paint over old paint on a metal surface, as it merely results in blistering.

Tank Cars. New cars are to have surface prepared by removing all traces of rust, grease or oil, and then car body given one coat of red lead. When red lead has thoroughly dried apply one coat of No. 25 paint, to entire car, followed 24 hours later by a second coat of No. 5 paint.

Repaired cars will have new parts given two coats of paint—one of No. 25 and one of No. 5. Cars which have to be completely repainted will be sandblasted or scraped and handled as new cars.

Water Cars. New cars will be given two coats of No. 5 standard paint, allowing 24 hours between coats. Repaired cars will have newly applied parts given two coats of paint. Cars which require complete repainting will have newly painted parts given one coat of No. 5 paint, and then sprayed with a coat of No. 5 paint. Trucks will not be repainted unless repaired, but if repainted will be given two coats of No. 5 paint.

Flat Cars with wooden end sills and side sills. New cars are to be given two coats of No. 5 standard paint allowing 24 hours between for drying. Repaired cars will be given two coats of paint on newly applied parts, but if complete painting is necessary give new parts one coat of No. 5 and spray entire car with one coat of "one coat" paint. Do not repaint trucks unless repaired, but in repainting give two coats of No. 5 paint.

Flat Cars, All Steel. New all steel flats will be painted after proper preparation of surface with two coats of paint—one of No. 25 and one of No. 5, allowing 24 hours between for drying. Trucks will be given two coats of No. 5 paint.

Repaired cars will have two coats of paint applied to new parts. Cars needing repainting will be scraped or sandblasted, and handled as new cars.

Stock Cars. New stock cars will be given two coats of No. 5 standard paint. Repaired cars will have new parts given two coats of paint, but if car requires complete repainting new parts will be given one coat of paint and then entire car sprayed with "one coat" paint.

Refrigerator and Vegetable Cars. New cars are to be given two coats of No. 5 paint, applied to roof, body, underframe and trucks, allowing 24 hours between for drying. Refrigerator interiors will be given a coat of linseed oil, followed by a coat of mixing varnish.

Repaired cars will be given two coats of No. 5 paint on newly applied parts, or if car requires complete repainting one coat on new parts and car then sprayed entirely with "one coat" paint. New interior refrigerator parts will be oiled and varnished as described following repairs.

Cabooses. New cabooses will be painted as follows.

Outside. Body (excepting roof) is to be given one coat of standard caboose primer No. 5. All nail holes are to be puttied flush, and putty

shellaced. When dry, a second coat—of standard caboose A-1 red—is to be applied. Following this entire body of caboose is to be given a coat of Acme caboose red. Allow 24 hours between coats for drying. Glazing to be done between coats. Roof will be given two coats of No. 5 standard freight car paint.

Inside. Whole of interior excepting floor to be primed with one coat of caboose inside ceiling primer. All nail holes to be puttied flush. Apply to ceiling a second coat of ceiling color; from ceiling to bottom of window sills a second coat of standard caboose side wall color; and from sills to floor, including the seats, a second coat of standard caboose base color.

Repaired cabooses, while on repair tracks, will have new sheathing primed, nail holes puttied flush, and whole caboose then sprayed with “one coat” caboose No. 41 red. The inside will be washed and ceiling given one coat of ceiling color, from ceiling to bottom of window sills one coat of standard caboose side wall color, and from sills to floor, including the seats, one coat of standard caboose base color.

Para. 3 PASSENGER CAR STANDARD PRACTICES

Sub-para. (I) OUTSIDE METHOD OF CLEANING PASSENGER TRAIN CARS

No material other than that described in “Standard Materials” is to be used, and under no circumstances shall boiler compounds or other solutions be experimented with in an effort to obtain a temporary good appearance for a car, as it will result in the destruction of the varnish.

Class 1 Cleaning. Passenger cars which are dirty on the outside and do not present a good appearance are to be washed and scrubbed, to loosen the dirt, with a solution of oxalic acid and water, mixed as follows:

To every barrel half full of hot water, add 20 pounds of oxalic acid and stir until acid is dissolved. When dissolved, fill the barrel full of cold water, stirring again thoroughly and the same is then ready for use. Under no conditions should hot solution of acid and water be used.

Follow this scrubbing with oxalic acid solution by washing car with plenty of clean water from the hose, particular care being given to the removal of dirt, grease and any traces of acid. The cleaning is to be carried out at the rate of once every four weeks, unless service conditions and the appearance of the car justify more frequent attention, such as would apply where cars remain out of shops beyond their allotted time, and in through service trains that are in daily service and require to be maintained at a high standard of cleanliness.

Class 2 Cleaning. This will supplement Class 1 cleaning to the extent of renovating the exterior after once being cleaned and shall be carried out immediately after the car is dry with an approved make of renovator, which will be supplied to Chicago, Kansas City, Omaha, Milwaukee, Minneapolis and Tacoma.

To apply this renovator, a handful of waste should be taken and moist-

ened with it and then applied to the car, care being taken to leave as little as possible on the car. After the renovator has been applied over the varnished exterior parts of the car, carefully wipe off twice with clean, dry waste. This waste will be serviceable to wipe cars off at end of each trip for a period of approximately 30 days, when car should again be thoroughly scrubbed with oxalic acid solution and washed with plenty of clean water as described in Class 1.

At designated stations certain classes of cars and equipment for certain trains will always be renovated after being washed and scrubbed with acid. Cars for through and specialized or local service are to be washed at the end of each trip with clear water (this being preferred to wiping) but should be renovated on the average of once every 30 days.

Special Cleaning. In all cases of business cars, dining, parlor, cafe and sleeping cars, it will be necessary to use such further precautions in cleaning as their construction and service require, but general cleaning is to be done on the same basis as already mentioned.

Cleaning of Trucks. The regular cleaning of trucks under our passenger equipment cars should be given the same attention as is given the outside body of car. All dirt and grease should be cleaned from the trucks, by the application of a mixture of one pint of mineral seal oil to a pail of water, applied with a worn-down broom. If the paint is worn off of trucks or platforms, or new parts are applied, they should be touched up with our standard truck enamel after washing, when dry. Where cars have passed their regular shopping period, a thin coat of truck enamel should be applied to both platform and sides of trucks at intervals when needed.

General. Branch line and second class train equipment on which no renovator is used, is to be washed and scrubbed with oxalic acid every 60 days. Where renovator is used, it will be scrubbed with oxalic acid every 90 days. New and newly-painted cars will be renovated after making three to five trips.

Sub-para. (II) INSIDE METHOD OF CLEANING OF PASSENGER TRAIN CARS

No material other than that approved in "Standard Materials" is to be used. All passenger cars shall have doors, windows and deck sash opened immediately on arrival at cleaning yards, and they will be kept open as long as possible to secure a free circulation of air through the car during cleaning.

Class 1 Cleaning. Remove aisle strip from car, after which car should be thoroughly blown; head lining, side walls from seats to heater pipes, and seat arms are to be sponged with soap and water, mixed as follows: Thoroughly dissolve one pound of vegetable oil soap in a bucket of hot water, adding one pint of this mixture to each bucket of luke warm water used. After thoroughly washing inside of car with this mixture with the aid of a sponge, rinsing immediately with clean cold water, surface will be wiped dry with a chamois leather. Seats and backs of seats should be cleaned with compressed air. Saloons are to be mopped; wash bowls and hoppers cleaned with a sponge and water.

Water coolers must be removed from car and thoroughly cleaned out with live steam once a week in operation, and record kept of same in specially printed card in car provided for this purpose.

For washing out toilet rooms, cuspidors, etc., for the removal of unpleasant odors, and for the disinfection of postal, baggage and express cars use disinfectant as explained in "Standard Materials." This disinfectant can be used without damage to person or equipment.

Renovator is to be used at necessary intervals to correct dry condition of varnish or interior finish, using a small quantity worked into soft cloth, evenly applied to interior finish and thoroughly dry-rubbed to a polish. Care must be exercised to avoid getting any excess of the renovator on surfaces, otherwise the oil from same will find its way into corners, where it is difficult to remove or dry out. The use of renovator is authorized at the following points only: Chicago, Kansas City, Council Bluffs, Milwaukee, Minneapolis, Dubuque and Tacoma.

Brass work should be sponged off and globes and reflectors polished and window sills wiped off with soft cloth. Curtains should then be pulled half way down.

Inside of vestibule must be washed with soap and water and thoroughly dried. Vestibule car brass and hand railings, not lacquered, should be polished with metal polish at each cleaning.

Electric, gas or oil lamps must be kept in a clean and serviceable condition at all times; oil lamps in service cleaned daily and founts filled outside of car; the electric or gas lamps to be washed in warm water at least once every 30 days; for oil lamps, as frequently as required to be kept clean. Rigid inspection of all lights and tests of bulbs and shades is to be made daily.

Particular attention must be given to heater pipes and all dirt behind same removed. Heater pipes, foot rests and seat pedestals in coach chair cars and smokers are to be cleaned. Pipes and pedestals should be painted or bronzed when necessary.

Monolith and Flexolith flooring must be kept painted, to prevent their becoming water soaked. In mopping up floors care should be taken not to use too much water, nor allow it to remain too long, as they become water soaked and sour, and this gives the car a bad odor. The use of an undue quantity of water also causes damage to steel underframe equipment.

In cases where cars have been subject to contagious diseases, instructions for disinfecting and fumigating should be followed.

In cleaning of baggage cars, the fish racks must be removed and washed with disinfectant. This disinfectant is to be used at large coach cleaning points, such as, Chicago, Kansas City, Omaha, Milwaukee, Minneapolis and Tacoma, every time the car gets a general cleaning, or at the end of every trip, and at small outlying points it is to be used once a week. (Outside points will call on nearest main station for a supply of this material.)

This class of cleaning is to be given cars in main line and through service at the end of each trip, and cars in branch line service once a week. At least once a week cars with carpet will have it taken up and thoroughly cleaned, and sleepers will have bedding stripped.

Class 2 Cleaning. This cleaning pertains to passenger cars in branch line service. As soon as car arrives at place of cleaning, the doors, windows and deck sash shall be opened and kept open as long as possible to secure free circulation of air through the car while car is being cleaned.

Car should be thoroughly blown out or swept with bristle broom; then seats and backs should be thoroughly cleaned, interior woodwork dusted, after which plush on backs and seats is to be gone over with damp sponge to pick up lint and particles that may remain. Floor should then be thoroughly mopped, and when dry, swept.

Saloons are to be mopped, wash bowls and hoppers cleaned with sponge, using soap and water, and disinfected. Windows are to be thoroughly cleaned.

Class 3 Cleaning. This cleaning is to be done in cars used in through runs, where only five or ten minutes time is allowed while train is at station occupied by passengers. The car floor is to be sprinkled with water and swept with counter brush, using dust pan, and banana peelings, papers and all rubbish removed. Window sills should be dusted; cuspidors taken out of car and washed thoroughly, using disinfectant, saloons mopped and urinal bowls and hoppers cleaned with sponge and water, using disinfectant; vestibule platforms to be swept off; smoking room of chair cars and coaches to be mopped; platform and steps to be brushed off, and in winter weather, snow and ice to be removed and hand railings to be wiped off with waste. Special attention is to be applied locally, as, for instance at Portage on No. 4, so that day coaches will be cleaned and ready for passengers at Milwaukee. Also precautions along these lines are to be provided at other points on high class trains, as conditions require.

Special. In all cases of business cars, dining, parlor, cafe, sleeping and postal cars it will be necessary to use such further precautions in cleaning as their construction and service require, the general cleaning to be done on the same basis as already mentioned. In business cars every opportunity should be taken to give the cars and carpets and fixed cushions on chairs a thorough cleaning.

In postal cars, special attention should be given to lights, mail boxes, drawers, hoppers and coolers.

Dining cars should be cleaned thoroughly at all times inside and out, and special attention given to any work that can be done in kitchens, lavatories and saloons, when provided.

All brushes, brooms, tools and materials, etc., used in cleaning passenger equipment should be disinfected.

General. The work of fumigating a car is to be performed only upon

report that car has been subjected to contagious or infectious diseases. Doors must be closed tightly and if necessary sealed to prevent gases escaping. First sprinkle floor with clean hot water. Temperature must be not less than 65 degrees Fahrenheit. Fumigation must be done before the carpet or anything is removed or cleaning begun. Close all outside doors and raise closet seats. If car has dry hoppers, stop up chutes at bottom. Pull seats forward and loosen pillows in pillow boxes. Open upper berth and lay headboard across the seats so that one corner rests upon a seat arm. Lay lower mattress on the headboard with middle arched upwards, by placing the ends together. Raise curtain poles and hang curtains near the ends by a single hook. Throw blankets over curtain poles, making as few folds and thicknesses of cloth as possible. Arch the upper mattresses in berths. Soiled linen in the lockers must be pulled out and scattered in passage. It is necessary to make the greatest possible surface exposure of the contents of the car so as to insure the best results. Keep car closed for not less than 3 hours. When fumigation is completed, open all doors and windows and allow car to be thoroughly aired. For each 1,000 cubic feet space to be fumigated, not less than 16 ounces (1 pint) 40% Formalin (aqueous solution) or 2 ounces absolute Formaldehyde (Paraform) must be used.

All cars reported infected with bed bugs should be treated with the bedbug disinfectant solution indicated herein, and once a month thereafter in winter, or twice monthly during summer. The bedbug disinfectant solution should be prepared by combining:

3 quarts denatured alcohol
1 quart turpentine
3 ounces corrosive sublimate

which should be labeled POISON on all sides of the container. Preliminary to the cleaning and disinfecting of the car, in accordance with the foregoing regulations, this solution should be applied with a brush to all crevices and places which might harbor bedbugs. (If the application by a brush should not prove effective in some instances, then the solution can be applied as a spray, but as it is very corrosive to metals, and is very poisonous in spray form, it should not ordinarily be used in this manner.) This solution is very poisonous and therefore should not be brought into contact with the lips, and if any of it gets onto the hands they should be carefully washed thereafter. On the day following the application of this disinfectant the car can be fumigated and cleaned in accordance with the other regulations, noted above.

Sub-para. (III) HANDLING OF OIL LAMPS

Considerable complaint has been made regarding aisle strips and carpets being ruined by oil dripping from lamps, due generally to carelessness in filling the oil reservoirs; therefore, the following rules are to be observed:

Oil reservoirs are to be taken to platforms of the cars for filling, in order to avoid danger of spilling oil on carpets or floors. However, if the platforms of the cars are covered with inlaid rubber tiling or matting, the filling of oil reservoirs must be done on the ground.

In filling the reservoirs, the oil must be kept about one inch away from

the top, to allow for the expansion of oil when placed in warm car, otherwise, after expansion the oil is forced out, and the drip cups not being able to take care of the excess, oil is allowed to drop on passengers and on the floor.

When lamps are not burning, the wicks must be turned down until they are at least $\frac{1}{8}$ " below the top of the burner, to prevent syphoning of the oil, and the reservoirs should be locked in position to prevent rattling and injury to the valve. It will be noted that when reservoirs are locked in position oil will not syphon out provided wick is turned down as instructed.

When filling and replacing oil reservoirs make certain that oil is thoroughly wiped off and drain cups are emptied.

As the feed pipe in the Acme type of lamp is only $\frac{1}{8}$ " in diameter, and often becomes clogged with sediment and small particles of waste, the lamps should be taken down occasionally and blown out with air. When this type of lamp is applied to mail and wooden passenger equipment cars, point where application is made will arrange to see that a small sheet of brass is soldered to the bottom of each oil reservoir. This piece of sheet brass is to contain a certain figure, and a corresponding figure is to be stamped on brass button of lamp fount for the purpose of having oil reservoirs put back in the proper receptacle or lamp fount. The sheet brass piece on the bottom of the reservoir must also contain the number of the car, but it will not be necessary to put the latter marking on the oil founts or lamp frame.

This practice of marking will be followed in cases where cars go through shops for general repairs, and it is to be positively ascertained, by actual test, that the oil reservoirs are in their proper position before stamping is done, to see that no mistake is made as to mating of various parts.

Complaints are received from time to time from the postal authorities on account of the practice of lamp cleaners taking the founts down, standing them in a row, filling them and then replacing them in a hap-hazard manner. This must not be done.

In some cases the founts are changed by postal clerks, due to the fact that a certain lamp will be used a little longer than another and the oil will be come exhausted. We are making every effort to see that this practice is discouraged, but it makes it all the more necessary that we see to it that founts are placed in their proper position when they reach terminals, after being cleaned and filled.

In some cases the valve stem is too long and in others too short, causing a great difference in the feeding of the oil.

Oil lamps must be filled and in good working order before cars leave terminals. Lamps are to be lighted by carmen only at such time when cars leave terminals during hours when lamps are wanted—that is, if a train leaves a home terminal in the middle of the afternoon when it has not commenced to grow dark, it will be the trainmen's duty to light the lamps in the train later in the day, after they have proceeded to make their run.

In other words, it is desired that oil lamps shall not burn any longer than absolutely necessary for the convenience of the public. There is a tendency to light lamps too early in a number of trains originating at large terminals. Good judgment is required to obtain the desired results.

**Sub-para. (IV) WATERING AND ICING PASSENGER
CARS**

Passenger cars will, as far as possible, be watered at coach yards. Cleanliness is absolutely essential, and is to be insisted upon by supervisory forces.

Icing will be done as late as possible prior to departure of train, so as to ensure water being cool during the run. Omitting to ice or water a car causes much annoyance to travelers, and is a bad advertisement for the road.

Icing and watering when done while a train is enroute, should be carried out in the neatest and cleanest manner possible under the prevailing circumstances. A man with clean hands and presenting a reasonably tidy appearance, creates a good impression upon travelers, while a man dirty and untidy has the opposite effect.

Sub-para. (V) FIRE EXTINGUISHERS

Dry powder fire extinguishers are used in coaches, baggage and mail cars. This powder is effective as long as it remains in powdered form, which it should do indefinitely if provided with an air tight container, but if the containers are allowed to leak, moisture will enter and solidify the powder.

Before placing these extinguishers in service, to protect against leakage to the cap, same should be dipped in paraffine so that this will prevent moisture from entering at this point.

To protect the efficiency of these fire extinguishers, once each six months one out of a bank of six extinguishers should be examined and if it develops that the powder is caking, all the extinguishers in the bank should be emptied and refilled.

Sub-para. (VI) BACK-UP AIR HOSE

Trains have been stopped by emergency application of the brakes, due to rear end back of hose, jarring off the railing and catching crossing planks, tearing the pipe off the air hose.

Investigation develops these back up pipes are not always maintained in accordance with standard practice as shown on print No. 19509-E, the main pipe having been found shorter than called for, also the goose neck.

The shortening of the pipe may have been caused by pipe breaking or leaking and threads having been cut further back, but in no case must the pipe be shortened, and practice shown in print accompanying M. E. Circular Letter 1032 is to be adhered to.

Sub-para. (VII) COUPLERS

As cars pass through shops filler blocks are to be applied to all long

shank passenger couplers to prevent them bending. Details are given in M. E. Circular 1013.

Sub-para. (VIII)

AIR BRAKES

Investigation has been made in regard to the erratic action of triple valves on L. N. equipped passenger trains, and it has developed that this erratic action only occurs in triple valves which are equipped with the old type of by-pass valve Piece No. 36208 and Spring Piece No. 13861.

It was further determined that it was impossible to produce erratic action on triple valves equipped with the later type of by-pass valve, Piece No. 51529 and Spring Piece No. 53003.

In order to overcome the undesired quick action on our passenger trains from this cause, when "L" type of triple valves are found having the old type of by-pass valve, Piece No. 36208, same should be removed and by-pass valve, Piece No. 51529 and Spring Piece No. 53003 to be applied. Sketch showing the different types referred to accompanied M. E. Circular Letter 1027.

Sub-para. (IX)

**STANDARD MARKINGS FOR
PASSENGER CARS**

System passenger cars will be stencilled with yellow paint (imitation gold), in accordance with the following stencil diagrams which are obtainable upon application:

For Mail, passenger and express, 19083-D;
For Coach, Sleeping, Parlor, and Parlor Observation, 18959-D;
For Tourist and Dining Cars, 18960-D;
For Baggage Cars, 20272-D;
Interior marking, 19343-D;
Stencilling for trucks, 18865-D;
Lettering for Doors and Vestibules, 19176-D;

Details of letters on Prints Nos. 19150-D, 19149-D, 19148-D, 19147-D, 19125-D, 19036-E, 19037-E, 19038-E, 19039-E, 19040-E, 19041-E, 19043-E, 19044-E, 19045-E, 19046-E, 19047-E, 19048-E, 19049-E.

Sub-para. (X)

**PAINTING OF PASSENGER TRAIN
CARS**

(a) *Steel siding cars*, whether coach, sleeper, diner, or private cars, *when cars undergo heavy repairs*, will be painted as follows:

OUTSIDE: Immediately after sandblasting car, apply one coat of metal body primer, and as soon as dry follow with a coat of body filled lead color. Allow 48 hours in which to dry. Surface must then be gone over and any imperfections in the steel filled by knifing in body filler, using only sufficient to fill the imperfections. Allow 24 hours to dry. Sand-paper with fine emery cloth, or sand-paper and water, to an even surface. Apply first coat of standard yellow body color, and after 24 hours for drying apply second

coat, and first coat of sign board color (on sign board) 24 hours later apply varnish color to body, and second coat sign board color, allowing 48 hours in which to dry. When 24 hours only have lapsed, letter car. Next, apply first coat of finishing varnish, allow 48 hours to dry and apply second coat of outside finishing varnish; allow four days to dry, when car is ready for service.

All new work on roof is to be touched up with one coat of standard roof paint. After 24 hours apply one full heavy coat over entire roof. If new roof is applied the boards under iron are to receive one coat of mineral paint—new roof iron should receive three coats of standard roof paint, allowing not less than 24 hours between coats.

After burning off and sand papering sash apply one coat of hard wood primer. When dry, putty all open joints and defects, then sand paper and apply first coat sign board color. When dry, apply second coat sign board color, grain mahogany, and apply two coats of outside finishing varnish.

Vestibule doors are to be treated in the same manner as sash.

All new wood on platform and steps is to receive one coat of mineral paint, puttied, and one coat of flat truck color applied to whole, followed by one coat of standard truck enamel. All grease, dirt and loose paint is to be scraped and cleaned off trucks, which will then be touched up with flat truck color. The whole outside of truck is then to be given one coat of truck enamel and stencilled per standard practice. Inside of trucks when new is to be given one coat of mineral paint; outside face of platforms, steps and trucks two coats of varnish.

One coat of engine black finish will be given hand rails.

Irons under car are to receive one coat of standard iron black.

All new wood in connection with deck and screens is to receive standard first priming, to be puttied, and one coat flat yellow body color applied to new work. The entire deck and screens are then to receive one coat of oil deck color.

INSIDE: After car has been thoroughly washed inside—repairs made and necessary scraping done—apply one coat of properly colored filler to all wood work that has been scraped or renewed. When dry sand paper clean, stain to match, and apply one coat of shellac over stain, putty all holes and defects to match color of wood. Sand paper and apply second coat of shellac; this to be sand papered lightly and finished with two coats of inside finishing varnish. 48 hours to be allowed between coats of varnish. After sand papering, all other wood work to receive one coat of inside finishing varnish and allowed to dry three days. Rub to semi-gloss with rubbing oil and fine pumice stone. Window stops, seat frames, inside of sash and doors to be finished the same as interior of car with the exception of rubbing. No oil rubbing to be done below window sills. Seat castings, foot rests, truss planks, pipes and pipe guards to receive one coat of varnish, mahogany color. The floor to receive two coats of floor paint, all holes to be puttied on first coat.

New headlining applied will have applied one coat of mineral paint to the back of lining before placing in position, after which front side will be primed with outside first primer. When dry, putty all holes and defects. Then sand paper and apply two coats of standard head lining color—allowing 48 hours between coats. Stripe ornament and apply two coats of inside varnish for finish. In handling old head lining, after properly cleaning with soap, pumice and water, the ornamentation when in good condition but the head lining color is bad, should be cut in with a match color of the head lining and varnished two coats. When ornamentation and color are both in poor condition, head lining should be well sand papered and given two coats of standard head lining color, redecorated and finished with two coats of inside varnish. The upper deck is to be varnished with the head lining and left in the gloss.

Berth fronts in sleeping cars are to receive an additional coat of varnish and to be polished to a high gloss.

(b) When *Steel siding cars* undergo *medium repairs* the method of painting will be as follows:

OUTSIDE: Thoroughly wash car with oxalic acid, pumice, soap and water. Sand paper, scrape off all loose paint and corrosion to bright metal. Touch up all bare metal with metal body primer; when dry putty and knife in all defects. When dry, sand paper and coat all putty spots with standard yellow body color. After 24 hours apply one coat of standard yellow body color over whole body, allow 24 hours to dry, then apply one coat of varnish color, and allow 48 hours to dry. Apply red sign board color same as for heavy repairs, after which apply first coat of outside wearing body varnish. After 48 hours apply second coat of outside wearing body varnish. After drying four days the car is ready for service.

All new work on roof is to be touched up with standard roof paint; after 24 hours apply one full heavy coat of roof paint over entire roofing.

Sash is to remain in car, be sand papered, touched up, puttied and coated with balance of car, using two coats of sign board color. Sash to be varnished with body of car.

Deck and screens are to be touched up with metal body primer and when dry have one coat of oil deck color applied over entire deck and screens.

Platforms, steps and trucks will have new wood and bare spots on platforms primed with standard mineral paint. Imperfections are to be puttied and touched up with flat truck color and then one full coat of standard truck enamel applied. All rust scale or foreign matter is to be removed from trucks which will then be touched up with flat truck color and one full coat of standard truck enamel applied. Stencil per standard practice. Outside face of platforms, steps and trucks will be given two coats of varnish.

Handrails are to be blackened with standard engine black finish. Irons under the car are to be blackened with standard iron black.

INSIDE: After car has been washed thoroughly inside and repairs made, apply one coat of properly colored filler to all wood work that has been scraped or renewed. When dry sand paper clean, stain to match and apply one coat of shellac. Putty all holes and defects with putty to match wood. Sand paper and apply second coat of shellac and finish with one coat of varnish. Such other parts of interior as are slightly bruised to be sand papered, touched up with shellac and one coat of varnish applied. When dry newly varnished work to be oil rubbed with pumice stone, balance of car to be oiled off.

When the head lining is in good condition apply one coat of interior varnish including upper deck. When the ornamentation is in good condition and color is bad, it should be cut in with match ceiling color and varnished with one coat of interior varnish. When ornamentation and color are both in poor condition head lining should be given two coats of color, redecorated and finished with two coats of interior varnish.

Seat Castings, Foot Rests, Pipes and Pipe Guards are to receive one coat mahogany or walnut color enamel, according to natural wood finish of car.

All bare wood of floor is to receive one coat of standard floor color, allowed to dry, and have one coat of floor paint applied over entire floor.

When in good condition in interior, but seat frames or window sills are bad, same to be scraped, refilled and varnished. Balance of car to be oiled off with oil polish.

(c) *Wood Siding cars*, whether coach, sleeper, diner or private cars, *when cars undergo heavy repairs*, will be painted as follows:

OUTSIDE: After paint has been burned off of body of car, sand papered and repairs made, car is to be primed with standard first primer. New wood to receive oil primer and sand papered work to receive hard wood primer. This is to stand four full days for drying. Before second coat primer is applied car is to be puttied on first coat. Putty all holes and rough places. Knife in all open grain wood and sand paper whole car. Second primer applied—allow 48 hours for drying. When dry, sand paper lightly and apply first coat, flat yellow body color—allow to dry 24 hours and apply second coat yellow body color—allow to dry 24 hours. Then apply varnish color—allow 48 hours to dry. Car is to be lettered on varnish color after 24 hours. First coat of red sign board color to be applied on first coat of yellow body color, followed by second coat of red sign board color after 24 hours. First coat of outside finishing varnish applied—allow to dry 48 hours and apply second coat outside body varnish—allow four days for drying, when car is ready for service.

All new work on roof is to be touched up with one coat of standard roof paint. After 24 hours apply one full heavy coat over entire roof. If new roof is applied the boards under iron are to receive one coat of mineral paint—new roof iron should receive three coats of standard roof paint, allowing not less than 24 hours between coats.

After burning off and sand papering sash apply one coat of hard wood primer. When dry, putty all open joints and defects, then sand paper and apply first coat sign board color. When dry, apply second coat sign board color, grain mahogany, and apply two coats of outside finishing varnish.

Vestibule doors are to be treated in the same manner as sash.

All new wood on platform and steps is to receive one coat of mineral paint, puttied, and one coat of flat truck color applied to whole, followed by one coat of standard truck enamel. All grease, dirt and loose paint is to be scraped and cleaned off trucks, which will then be touched up with flat truck color. The whole outside of truck is then to be given one coat of truck enamel and stencilled per standard practice. Inside of trucks when new is to be given one coat of mineral paint; outside face of platforms, steps and trucks two coats of varnish.

One coat of engine black finish will be given hand rails.

Irons under car are to receive one coat of standard iron black.

All new wood in connection with deck and screens is to receive standard first priming, to be puttied, and one coat flat yellow body color applied to new work. The entire deck and screens are then to receive one coat of oil deck color.

INSIDE: The inside method of refinishing will be exactly the same as for steel cars undergoing heavy repairs.

(d) When *Wood Siding cars undergo medium repairs*, the method of painting will be as follows:

OUTSIDE: Car is to be thoroughly washed with oxalic acid, pumice soap and water. After all repairs have been made, sand paper, scrape off all loose paint. Touch up all bare wood with hard wood primer and prime with first primer all new wood applied. When dry putty all holes and rough places. When dry, sand paper, putty and coat new work with standard yellow body color and coat putty spots. After 24 hours apply one coat of standard yellow body color over entire car. Allow 24 hours for drying and apply one coat of varnish color. Apply red sign board color same as previously described. Allow varnish color 48 hours for drying. After 24 hours, letter—apply first coat of outside finishing varnish—allow 24 hours for drying and apply second coat of outside finishing varnish—allow four days for drying, when car is ready for service.

All new work on roof is to be touched up with standard roof paint; after 24 hours apply one full heavy coat of roof paint over entire roofing.

Sash is to remain in car, be sand papered, touched up, puttied and coated with balance of car, using two coats of sign board color. Sash to be varnished with body of car.

Deck and screens are to be touched up with metal body primer and when dry have one coat of oil deck color applied over entire deck and screens.

Platforms, steps and trucks will have new wood and bare spots on plat-

forms primed with standard mineral paint. Imperfections are to be puttied and touched up with flat truck color and then one full coat of standard truck enamel applied. All rust scale or foreign matter is to be removed from trucks, which will then be touched up with flat truck color and one full coat of standard truck enamel applied. Stencil per standard practice. Outside face of platforms, steps and trucks will be given two coats of varnish.

Handrails are to be blackened with standard engine black finish.

Irons under the car are to be blackened with standard iron black.

Vestibule doors are to be finished the same as sash.

INSIDE: The inside method of refinishing wooden cars undergoing medium repairs will be identical with that for steel cars undergoing medium repairs.

(e) *Open platform cars* when cars undergo *heavy repairs*, will be painted as follows:

OUTSIDE: After paint has been burnt off of body of car, sand papered and repairs made, car is to be primed with standard first primer. New wood to receive the oil primer and sand papered work to receive the hard wood primer. Allow this to stand four full days. Car is to be puttied on first coat. Putty all holes and rough places, knife in open grain wood. Sand paper whole car. Apply second coat of primer—allow to dry 48 hours. Sand paper lightly and apply one coat of yellow flat body color—allow to dry 24 hours. Then apply first coat standard yellow body color enamel—allow 48 hours to dry and apply second coat standard yellow body color enamel—allow 24 hours to dry and letter with yellow lettering enamel. After 24 hours apply one coat of outside finishing varnish to the letter board and numbers to protect against cleaning while car is in service. Four days after last coat of enamel is applied, car is ready for service.

All new work on roof is to be touched up with one coat of standard roof paint. After 24 hours apply one full heavy coat over entire roof. If new roof is applied the boards under iron are to receive one coat of mineral paint—new roof iron should receive three coats of standard roof paint, allowing not less than 24 hours between coats.

After burning off and sand papering sash apply one coat of hard wood primer. When dry, putty all open joints and defects, then sand paper and apply first coat sign board color. When dry, apply second coat sign board color, grain mahogany, and apply two coats of outside finishing varnish.

Vestibule doors are to be treated in the same manner as sash.

All new wood on platform and steps is to receive one coat of mineral paint, puttied, and one coat of flat truck color applied to whole, followed by one coat of standard truck enamel. All grease, dirt and loose paint is to be scraped and cleaned off trucks, which will then be touched up with flat truck color. The whole outside of truck is then to be given one coat

of truck enamel and stencilled per standard practice. Inside of trucks when new is to be given one coat of mineral paint; outside face of platforms, steps and trucks two coats of varnish.

One coat of engine black finish will be given hand rails.

Irons under car are to receive one coat of standard iron black.

All new wood in connection with deck and screens is to receive standard first priming, to be puttied, and one coat flat yellow body color applied to new work. The entire deck and screens are then to receive one coat of oil deck color.

INSIDE: (*Coaches*). Car is to be thoroughly cleaned on the inside with soap and water. When car requires revarnishing, sand paper lightly all bruised and bare places, scrape, refill, stain, shellac and give whole car including lining and deck one coat of inside varnish and leave in the gloss. When varnish is badly checked and cracked in place of gloss varnish, substitute semi-gloss or flat varnish. If car is in good condition but seat frames and window sills are bad, same are to be scraped, refilled and revarnished and balance of car is to be oiled off with standard oil polish.

Seat Castings, Foot Rests, Pipes, etc., are to receive one coat of mahogany or walnut color enamel according to natural wood finish of car.

All bare wood of floor is to receive one coat of standard floor color, allowed to dry and one coat of floor paint applied over entire floor.

(f) *When Open Platform cars undergo medium repairs*, the method of painting will be as follows:

OUTSIDE: Car is to be thoroughly cleaned with oxalic acid, soap, pumice and water. After all repairs have been made sand paper and touch up with hard wood primer all bare wood. All new wood is to receive one coat first primer. When dry necessary puttying only will be done. When dry, sand paper putty and coat putty spots with first coat yellow body color, or if old paint is dried out apply first coat body color with a little boiled linseed oil added to it over the whole body. Allow 24 hours to dry—then apply one coat of standard yellow body color enamel—allow 48 hours to dry and apply second coat yellow body color enamel. After 24 hours letter with yellow lettering enamel. Allow to dry 24 hours and apply one coat of outside finishing varnish to the letter board and number to protect against cleaning while car is in service.

All new work on roof is to be touched up with standard roof paint; after 24 hours apply one full heavy coat of roof paint over entire roofing.

Sash is to remain in car, be sand papered, touched up, puttied and coated with balance of car, using two coats of sign board color. Sash to be varnished with body of car.

Deck and screens are to be touched up with metal body primer and when dry have one coat of oil deck color applied over entire deck and screens.

Platforms, steps and trucks will have new wood and bare spots on platforms primed with standard mineral paint. Imperfections are to be puttied and touched up with flat truck color and then one full coat of standard truck enamel applied. All rust scale or foreign matter is to be removed from trucks which will then be touched up with flat truck color and one full coat of standard truck enamel applied. Stencil per standard practice. Outside face of platforms, steps and trucks will be given one coat of varnish.

Handrails are to be blackened with standard engine black finish.

Irons under car are to be blackened with standard iron black.

INSIDE: (*Coaches.*) The method of refinishing the interior of open platform coaches undergoing medium repairs will be the same as for open platform coaches undergoing heavy repairs.

(g) *Express, Mail and Express, Mail and the Express End of Passenger and Express cars* will have the interior handled as laid down herein. The exterior of these cars will be handled in accordance with the previous instructions for the particular class of car involved, but the interior is to be thoroughly washed with soap, pumice and water. All bare or bruised wood is to be touched up with white lead paint and puttied where necessary with white lead putty. The upper ceiling, deck and lower ceiling are to receive one or two coats of No. 104 standard ceiling color. The side walls will receive one or two coats of No. 105 standard side wall color as necessary.

Steam Pipes and Truss Planks are to receive one coat of standard truck enamel.

Mail Tables, Mail Counters, Paper Slides and Stops and Face of Letter Cases of hard wood and all Mailing Furniture where they are now natural wood should be shellaced and varnished.

Metal Letter Cases that are now aluminized are to be re-aluminized.

Mail Racks and other small iron work are to receive one coat of black varnish color (semi-gloss).

Safety Rods in mail cars are to receive one coat of black varnish color (semi-gloss).

Baggage Car Fish Beds and Fish Racks are to be painted standard mineral color.

(h) *Express Refrigerator Cars* when undergoing repairs will be painted as follows:

Cars are to be thoroughly washed on the outside with oxalic acid, soap, pumice and water. Inside washed clean with soap and water and disinfected. Sand paper the outside. Dig out all loose putty. Touch up bare spots with hard wood primer and prime any new wood with first coat primer. Putty, sand paper and give entire body one coat standard yellow flat body color—allow 24 hours to dry. Then apply one coat of standard yellow body color enamel—after 48 hours apply second coat of standard yellow body

color enamel. Allow 24 hours to dry and apply two coats of standard yellow lettering enamel and edge with oxide red striping color and all letters and numbers are to be stencilled.

Apply two coats of our standard No. 5 freight car paint to roof.

Trucks are to be sprayed with standard iron black.

Apply one coat of iron black to underframe and all irons under car.

All new wood is to receive one coat of boiled linseed oil, allowed to dry and two coats of mixing varnish applied. All old interior is to receive one coat of mixing varnish.

Para. 4 GENERAL STANDARD PRACTICES

Sub-para. (I) PREPARING AND RECLAIMING JOURNAL BOX PACKING

There is no field opened by one single item in which such scope for improvement offers as in the handling of journal box packing. The methods used generally give only a percentage of the required standard of efficiency, and as a result contribute largely to the epidemics of hot boxes which embarrass our operations from time to time.

These instructions are therefore to be rigidly observed and report made in any cases where difficulty is found in following them.

In preparing new waste for freight car journal box packing, a known quantity (say 50 lbs.) will be taken and carefully pulled apart, and placed in a clean preparation vat, *free of any oil*. In pulling packing apart it should be rolled up very loosely, somewhat in the form of balls, so that long strands will not run through a pile of prepared packing and finally go into a journal box in such a way as to offer every chance of a waste grab. This does not mean a labored process. A small handful of waste should be grabbed with one hand, and with the other the long hanging threads quickly and loosely wound around it. Temperature of room must not be less than 70 degrees, preferably 85 or 90. Pour evenly over the waste oil in the ratio of four pints to each pound of waste. Oil should be drawn off from the bottom of the vat and poured over the top again, four times daily. Where vats are so constructed that oil cannot be drawn off from the bottom, waste will be placed directly into the oil and allowed to soak. At the end of 48 hours waste—which, in the case of freight, is cotton, and retains oil nearer the surface than wool—is ready for draining. Draining will be done by placing on rack, heaped to a depth of not more than 7 or 8 inches.

In handling old packing, first pull it apart, fill vat to a depth of 6 or 8 inches with oil, which is to be made as warm as possible without foaming, and waste taken a little at a time and whirled around in the hot oil so as to describe a figure eight. This should be done in such a way that waste will string out and, tail-like follow the fork, without in any way coming into contact with the bottom of the vat. Each fork of waste so handled will be placed on the rack in such a way that it will drain readily; to obtain good results it should not be heaped deeper than 7 or 8 inches. Packing is then ready for use.

If the right class of labor can be obtained, the screen should be removed from the bottom of the vat, as it only becomes blocked up with short pieces of waste, and dirt remains on top. If, however, only poor class labor is available, it is better to leave the screen in, and make the packing preparer comb the screen with the end of his fork every half hour. Each morning before commencing handling more packing a shovel must be taken, and the accumulated dirt at the bottom of the vat very carefully picked up and placed in a gunny-sack suspended above the vat in such a way that the oil may drain back. When the screen is used it will be removed before attempting to pick up the dirt as described. The dirt collected in the gunny-sack will be dropped into casks, which, when sufficient are filled, will be emptied out during a fine day and babbitt recovered. All babbitt recovered by this means will be shown on Savings Reports each month.

Vats are to be completely cleaned out periodically. The length of time between cleanings will vary in accordance with local conditions. At small points once a month will suffice, but at shop points and places where vats are in constant use, it will be necessary every week or 10 days. Before cleaning out a vat the oil should be allowed to get as low as possible, then drained off, and vat thoroughly cleaned out. The oil drained off will be strained through a double layer of fine muslin or cheesecloth, or filtered by some similar process, and then used for lubricating center bearings, coating stored axles, etc.

Oil houses must be kept scrupulously clean, free from dust, and nothing allowed to be thrown in with packing that might carry any dirt. Oil houses are to be regarded more in the light of laboratories for the scientific preparation of packing than "dope shanties." A metal container or suitable receptacle should be available for the storage of rolls that have been made up of dry waste, after which they are submerged in oil. These rolls, measuring approximately 11 inches by $2\frac{1}{2}$ inches in diameter, do not carry much oil, and are ready for immediate use, and are placed in the back of the oil box in such a way as to assist in excluding dirt.

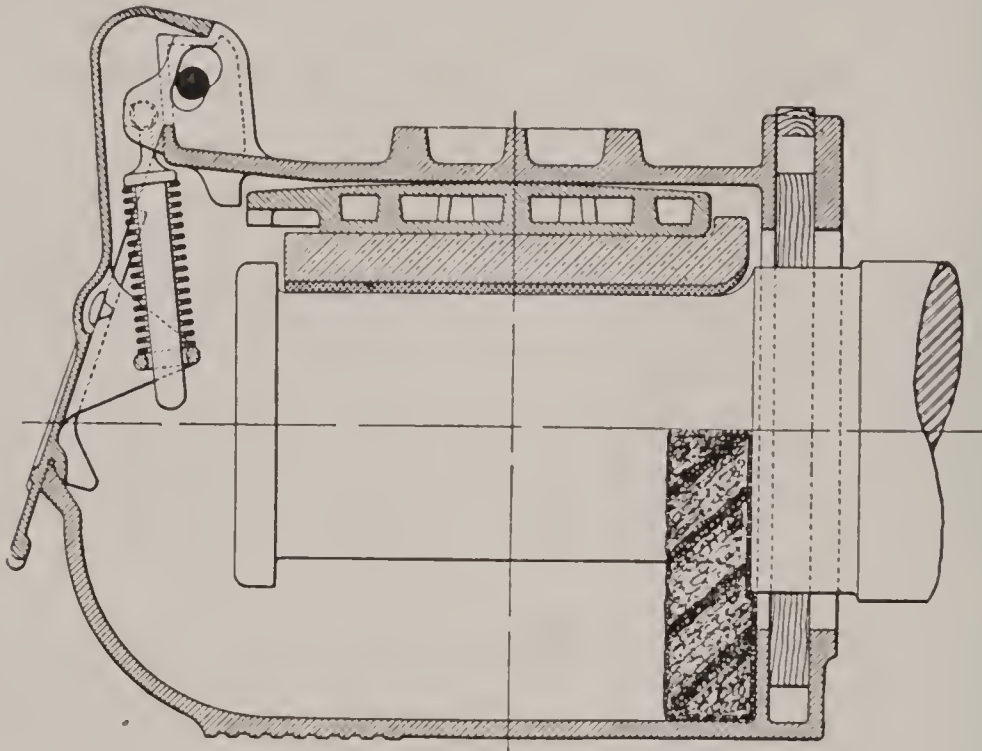
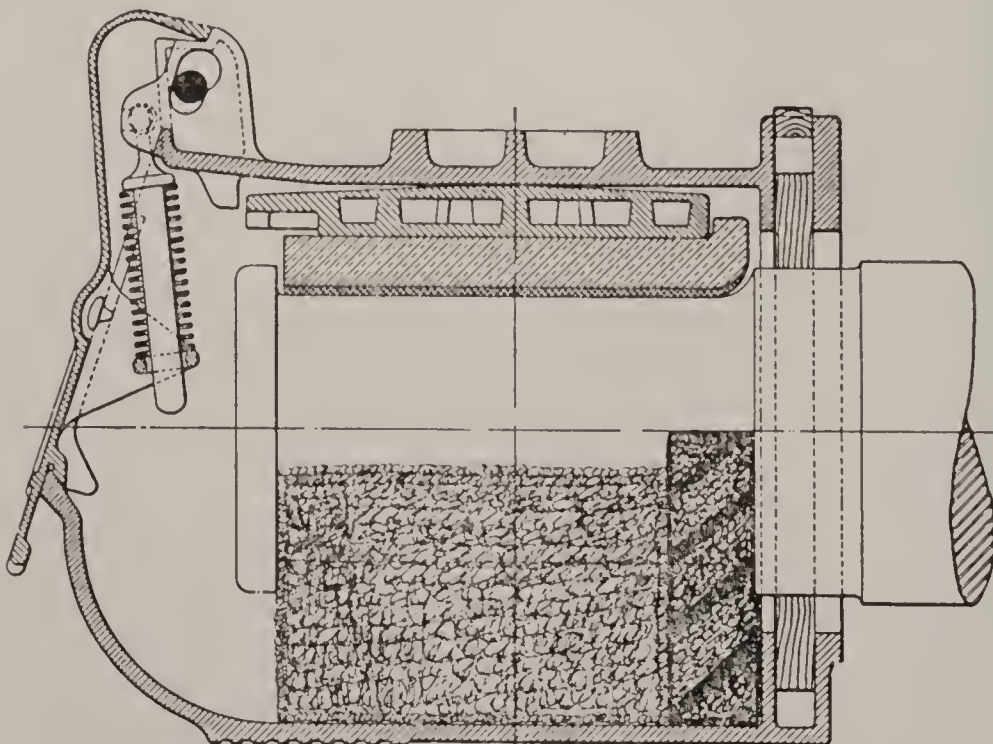
Nothing but a standard dope bucket is to be used for carrying packing to the cars, and after a train has been gone over all packing remaining must be returned at once to the storage tank until next train arrives.

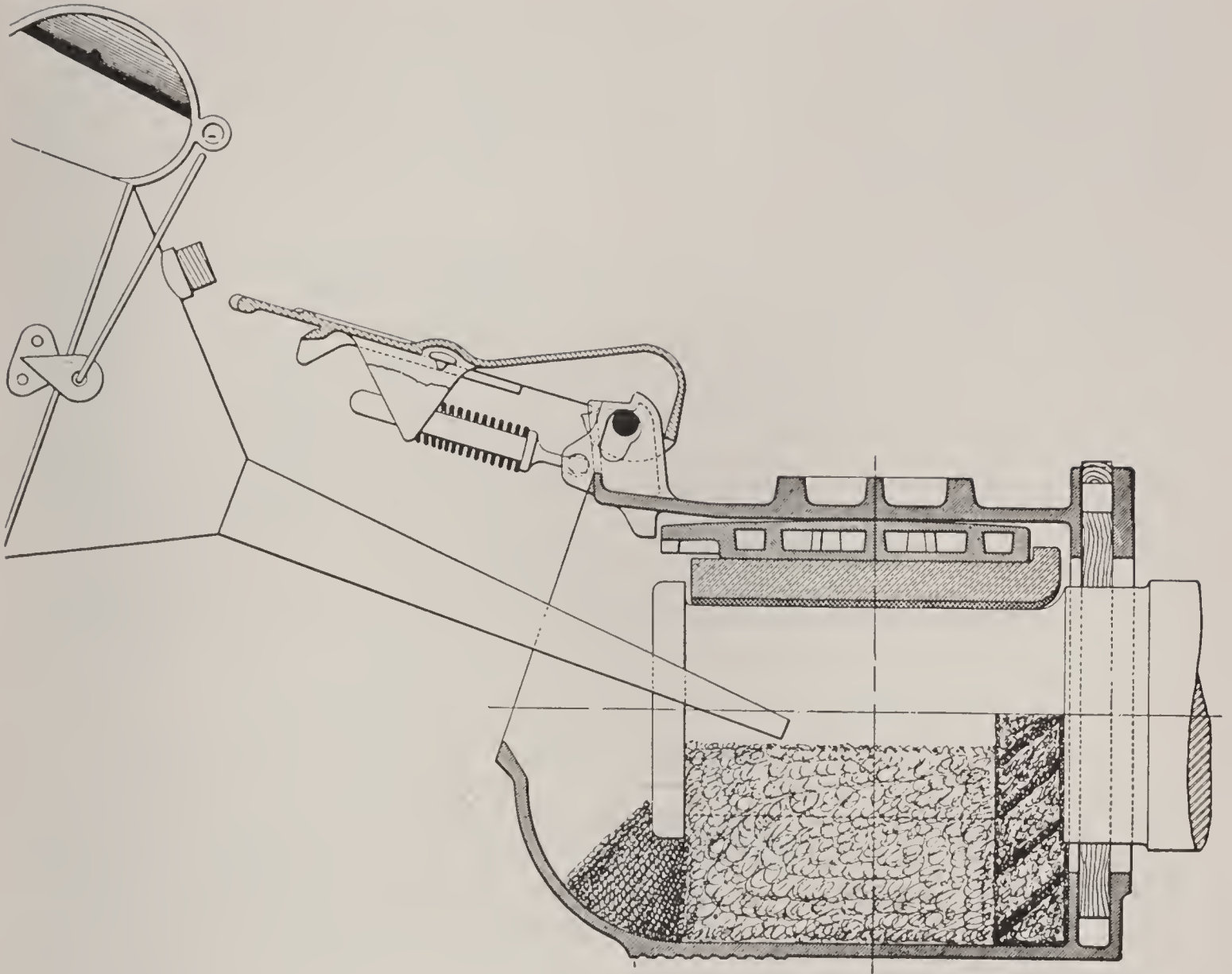
In handling passenger car packing the same procedure will be followed. Waste will be pulled apart and wound into balls as described. In washing old packing the work must be very carefully carried out, otherwise the waste—being a mixture of 50% wool and 50% cotton, machine mixed—will continue to hold the dirt.

The necessity for keeping oil houses in perfect condition, and carefully following these instructions, is repeated. Our equipment operates through country varying in the course of a few hours' run from sand and dust to rain and snow, and epidemics of hot boxes are unavoidable until every point on the system produces and uses nothing but perfectly clean packing, thoroughly prepared.

Sub-para. (II)**PACKING JOURNAL BOXES**

The prepared packing will be taken to side of car in a standard dope bucket. A standard packing iron is to be used, with a sharp end, and the forked end of this packing iron should be maintained in its original condition at all times, as continual use wears down this end. The packing iron should also have a lug about 12 inches from the hand hold which is used to open box lids. A suitable pulling hook should be carried by each dope man.

**Figure 1****Figure 2**



The first waste introduced into the journal box must be a small quantity, wrung moderately dry, twisted and packed up tightly around the axle at the back end of the box to assist in forming a dust guard. (See figure 1.) After this, packing should be introduced in small bunches and packed firmly enough to prevent its falling away from the journals, but not so tightly as to squeeze out the oil. The packing should be kept one inch below the brass on the sides of the journal, and should be flush with the end of the journal. (See figure 2.) After the box has been packed in this manner, a bunch (or plug) that must be distinct and separate from, and have no thread connection with the packing under the journal, should be applied in the front end of the box. (See figure 3.) It should not come up higher than lower part of collar. No threads of waste should protrude from either end of the oil box.

When the movement of cars is reversed while en route, it is found that the packing works to the rising side of the journal in a great many instances and will remain in that position in the reverse movement, if not adjusted, causing journals to heat, as packing in this position will not readily feed oil to the journal.

Sub-para. (III)

JOURNAL BEARINGS

Improperly or carelessly applied linings to journal brasses have a far reaching effect. Trucks may be built and finished in a first class work-

manlike manner, wheels properly taped and mated, and bearings properly fit boxes and wedges. However, if the lining in the brasses has been put in carelessly and out of center as much as one-sixteenth of an inch or the extreme of one-quarter of an inch, which inspection has proven in many cases, the effect that it has on the wheel flange, rails, switch points and frog cannot be other than destructive.

If, for comparison, two brasses with the same defects were to be put in oppositely at the two ends of axle, it then doubles the angle of error between the wheels and the rail. This condition is liable to lead to a derailment, owing to the fact that the brasses are lined out of center, making the wheels lead to one side and crowd hard against the rail, while a switch may be set to lead wheels to the opposite side to which they are crowding. In such a case if the wheels and switch points are partially worn and the car is a little close on side bearings a combination is set up which is hard to overcome and which is very liable to cause a derailment.

Cut flanges will also result and this extra friction is just as bad as brakes hugging the wheels to a certain extent and causes train to drag heavily, and more power, fuel and time is required to get over the road.

Hot boxes are also invited with resultant delays and inconvenience.

Two vital factors must be given consideration in lining brasses, the handling of the babbit and application of same. A common error is to apply babbit at improper temperature, and another is applying the babbit at an angle in brass due to incorrect setting of the brass on the mandrel. This causes improper bearing, acting the same as a pinched brass, and will invariably cause a hot journal.

If the lining metal should happen to be too soft, the unequal distribution of the bearing metal in the brasses, will mean that the axle bearing will be at the point where the metal is the thickest, thereby causing it to slough out until an even bearing for the journal is reached.

The same general practice in babbiting is usually followed, but there is often a tendency to neglect details in connection with such points as:

1. Properly cleaning and tinning shells.
2. Preheating of mandrels and shells before babbiting.
3. Correct temperature of the alloy.
4. Handling and pouring of alloy in shells.

The tinning alloy, half and half solder, should be melted in an iron or steel pot in which the temperature of the metal should be maintained between 770 degrees and 824 degrees F. If the pot is used only occasionally the melted alloy should be covered with sawdust or charcoal to prevent the formation of dross. The metal should be stirred frequently when being used and always before using, after it has stood for any length of time in a molten condition.

The operation of tinning shells that are to be babbitted consists of coating the surface to be babbitted with a thin film of half and half solder. Swab parts to be tinned with zinc chloride and then dipped into tinning solution. Leave the shell in the pot until it is just hot enough for the tinning alloy to run off. Remove the shell from the pot and thoroughly rub the surface to be tinned with zinc chloride, making sure that all parts have a thin coating of the alloy and that no spots are left on the surface to be babbitted. Immerse the shell again in the tinning alloy to remove the acid left from the swab and do not swab or otherwise touch the tinned surface again but babbitt immediately.

Mandrels used in babbitting should be heated to prevent chilling of the babbitt when poured and should be coated with a thin wash of red clay mixed in water to prevent the babbitt from sticking to the mandrel and to prevent blow-holes in the babbitted lining. This coating may be applied with a brush or a swab and should be done before babbitting each shell. Best results can be obtained by preheating mandrels from 212 to 257 degrees F.

The bearing metal must not be allowed to become hotter than 914 degrees F. at any time and it should not have alloys mixed with it.

Mix the metal thoroughly from the bottom of the pot as soon as melted, again at frequent intervals when being used, and always just before using after the metal has been standing in a molten condition for any length of time. If the pot is used only occasionally, cover the babbitt with sawdust or charcoal to prevent the formation of dross.

Pour all bearings in a vertical position and pour in a steady stream directly along the mandrel to avoid pocketing the air. Small blow-holes, if few in number should be filled in with the babbitting metal by the use of a hot soldering iron.

If the blow-holes are large in size and number, or if same have formed, the lining should be melted out and the bearing re-babbitted.

Do not use a coarse rasp to round the fillet as this causes it to become too rough.

If a small line shaft is available, a disc with a crank pin connected to a rod and terminating in a flat perforated plate can be employed to furnish an up and down movement in the pot to agitate the metal.

Drawings C-458 and D-761 accompanying M. E. Circular Letter 1055, show a mandrel, in which it is next to impossible for the operator to get brass out of line, or to have any taper. The guides on the side of the mandrel are for the edges of the brasses to rest on, causing the lining to be parallel with back of brass and avoiding the likelihood of a tapered lining. It is only necessary to have burrs brushed off of the edges of the brass where it bears on guides to insure a correct alignment. The centering feature is a "V" block placed at the end of a guide bar that rests in the bearings, which are in line with the center of the mandrel. This "V" block has four bearing strips, two at the top and two at the bottom, these being

thick enough to allow for the height of the keeper lugs on engine truck brasses. The drawings show a hand operated machine; however, it can readily be arranged to operate with air.

Sub-para. (IV)

APPLYING BRASSES

Brasses are either solid or filled, the latter being distinguishable by the letter "F" stamped on the crown surface. In applying first see that the wedge rests on the crown of the brass with some clearance on the sides. All new journal bearing wedges have a crown of almost $1/16''$, and this should be maintained in order to obtain good results in service. Wedges having crowned top surface worn flat and smooth for a length from front to back of more than 4 inches should be removed and replaced with new wedges where practicable.

Next cover the surface of the brass with a thin coating of oil, which should be squeezed from the packing or poured direct from the can, and move brass back and forth a few times on the journal. Remove carefully and if face shows that it bears on edges of the brass, the brass is too small in radius, which would cause it to heat. If the brass bears along the crown for its whole length and from $1\frac{1}{2}$ to 2 inches in width and clear of contact at the edges, it is of proper size. The face of the brass should be oiled before applying, by squeezing oil from the packing. *Do not wipe with oily waste.*

Apply the wedge on top of the brass after the brass has been placed on the journal and be sure that the wedge is back in proper position and not resting on the lugs which hold it in position in the crown of the journal box. In lowering the journal box, be sure that the wedge and brass are properly seated.

Sub-para. (V)

**TREATING HOT BOXES IN YARDS AND
DEPOTS**

Remove packing, placing in clean bucket, jack up car, remove brass and wedge. Examine journal, replace brass or put in new one, and repack box. (Details given under "Journals", in paragraphs dealing with inspecting freight and passenger trains, Section I.)

Sub-para. (VI)

TREATING HOT BOXES ENROUTE

In laying down a method of treating hot boxes for train crews, the following should be remembered:—Prepared packing and tools are assigned as a part of the train equipment; they consist of a standard bucket, packing iron and hook. Trainmen should see that the packing is protected from dirt and water.

It should be the duty of the trainmen when taking cars at points where there are no car inspectors to examine the journal boxes and see that they are in proper condition for safe movement. A little time and attention may save the annoyance of a hot box and serious detention to the train.

When there is evidence of a journal heating, open the box lid, insert the packing hook along the journal to ascertain if the packing is in contact with

the journal for its entire length and that the journal is not cut. If the packing is not in contact with the journal and the journal is not cut, add fresh packing, if necessary, or raise the packing in the box as described, so that it may have proper contact with the journal. If it continues to heat, a new brass should be applied.

In applying a new brass, first remove the packing from the box, placing it in a bucket, or in some other manner protecting it so that it will not come in contact with the ground; then jack up the box. Frequently when jacking up the box, the wheels will rise from the rail, holding the brass and wedge against the crown of the box. A block plated from top of the wheel to the sill of the car will prevent this. When the brass and wedge are free from weight, insert the packing tool along each side of the brass and pull the brass and wedge forward out of the box; this is done to keep the brass from turning to the under side of the journal and dropping to the bottom of the box. Packing removed from the journal and not used in the repacking of the box should be returned to the point designated by official order of the respective division.

When water is used for cooling, it should not be applied until the journal has cooled to a low temperature, and should not be used until brass has been removed. If a journal was of red or white heat, notice should be given at the end of the run or at the point of cut-out, if the car is cut out, that the journal has been cooled by water, in order that it may be removed at the first opportunity. This can best be shown on Train Inspection Certificate Form No. 975, carried with each train.

Carefully examine the journal with the packing hook to determine rough or cut places. Condition of journal should be mentioned on report of hot boxes.

If the car having a hot box is set off at a siding, or brought into a terminal, the box should be plainly marked by the trainmen in the absence of an inspector. This mark must remain thereon until removed by the car inspector or repairer after the box has been properly cared for. A box thus marked will indicate to the car inspector or repairer that it has given trouble on account of heating and requires attention.

(It should be noted that car inspectors have explicit instructions not to attempt to cool a red journal with ice or water until 10 minutes after discoloration has disappeared.)

Sub-para. (VII) STENCILLING JOURNAL BOXES REPACKED

Boxes repacked are to be stencilled as shown in blue print accompanying M. E. Circular Letter 1035. (Boxes are to be repacked at periods of not more than 12 months—system cars 9 months whenever practicable.)

Sub-para. (VIII) JOURNAL BOX LIDS

In order to reduce to a minimum the number of hot boxes and cut journals, occasioned by loose and poor fitting journal box lids, the type of lid as shown on sketch accompanying M. E. Circular Letter 1054 is to

be used hereafter on all Tenders, Passenger Cars and System Freight Cars receiving class A, B, and C repairs, and new freight cars.

Where other repairs are given system freight equipment, and on all foreign freight cars where journal box lids are applied, the M. C. B. type of ordinary pressed steel hood type lid should be used.

Quantities of these can be reclaimed from the equipment as indicated above, which will receive the new standard hoodless lid.

When journal box lids are applied to system equipment they are to have the bolt rivetted over in all cases. ("Asco" journal box lids are now our standard.)

Sub-Para. (IX)

HOSE FASTENERS

The life of hose can be materially increased by the use of proper couplings and method of application of same, particularly on cut lengths of steam, washout, air, oil, water and miscellaneous hose used around shops, roundhouses and yards, etc.

It is most important that rubber cement be used freely on any couplings to be inserted in any hose. Couplings are usually larger and sometimes more than $\frac{1}{8}$ inch larger than the inside diameter of the hose and when the hard metal of the coupling is forced into the hose, it is very easy to injure the inner tube of soft rubber. The injury to the inner tube of rubber, even to the smallest pin point, will allow whatever the hose is carrying, whether it be air, water or steam to work in between the tube or lining and the duck, and the hose is thus ruined and put out of commission with a collapsed tube, perhaps five to thirty feet away from the coupling end.

Other causes of this same trouble are couplings used that have sharp edges on the sides or at the end. Never should a coupling be used that has any cutting surface on the outside that could possibly injure the lining or the inner tube of rubber. It is most important that all couplings should be smooth and free from any sharp edges or corners.

The application of the outside clamps is most important. On large size hose, also on all steam, washout, air and oil hose, two clamps should be used and the last clamp applied to the end of the shank of the coupling. should never be applied further than $\frac{1}{2}$ inch back from the edge of the end shank of the coupling that is inserted into the hose.

Sub-Para. (X)

MOUNTING AIR HOSE

We have experienced some delays on account of air hose nipples breaking off at the angle cock. Investigation developed in one case that only two threads were engaged and that the nipple was prevented from entering the angle cock any further on account of the rust accumulated on the threads. On a test made at one point it was found that the nipple would enter the angle cock an average of three additional threads when the rust was cleaned off the threads.

In future when reclaiming air hose nipples a die should be run over the thread to remove the rust and at points where angle cocks are repaired

the thread should be retapped for the same purpose, care being exercised in either case to not remove any of the metal. The threaded portions should be lubricated before placing in stock.

Sub-para. (XI) REMOUNTING CAST IRON AND CAST STEEL WHEELS

Gauges to be used in connection with the remounting of cast iron and cast steel wheels, together with instruction for their use, are shown in sketch accompanying M. E. Circular Letter 196

Sub-para. (XII) APPLYING WHEELS

When applying wheels to a car the journals must be thoroughly cleaned (rasp or emery paper not to be used). All information given under "Wheels" and "Axles" in Section I to be practically applied. Journals *not* to be wiped with oily waste, but a fine film of oil to be provided by direct pouring. Tight fitting dust guards to be applied with new wheels.

Sub-para. (XIII) ASCERTAINING AMOUNT OF SERVICE METAL IN STEEL WHEELS

The methods of ascertaining the amount of service metal remaining in wrot steel or steel tired wheels removed from service has not been generally satisfactory. In order to obtain the desired results it has been decided to supply all shop points with a special gauge, as per cuts below, for the express purpose of deciding amount of service metal remaining prior to turning wheel in lathe to restore full flange contour. These gauges have been obtained at heavy expense, and the Foreman or General Foreman to whom issued will be held personally responsible for the safe custody of the gauge in question. Outside points removing steel wheels will forward them at once to the nearest shop point, where they will be gauged without delay and advice of result forwarded by first mail to permit of completion of A. R. A. billing.

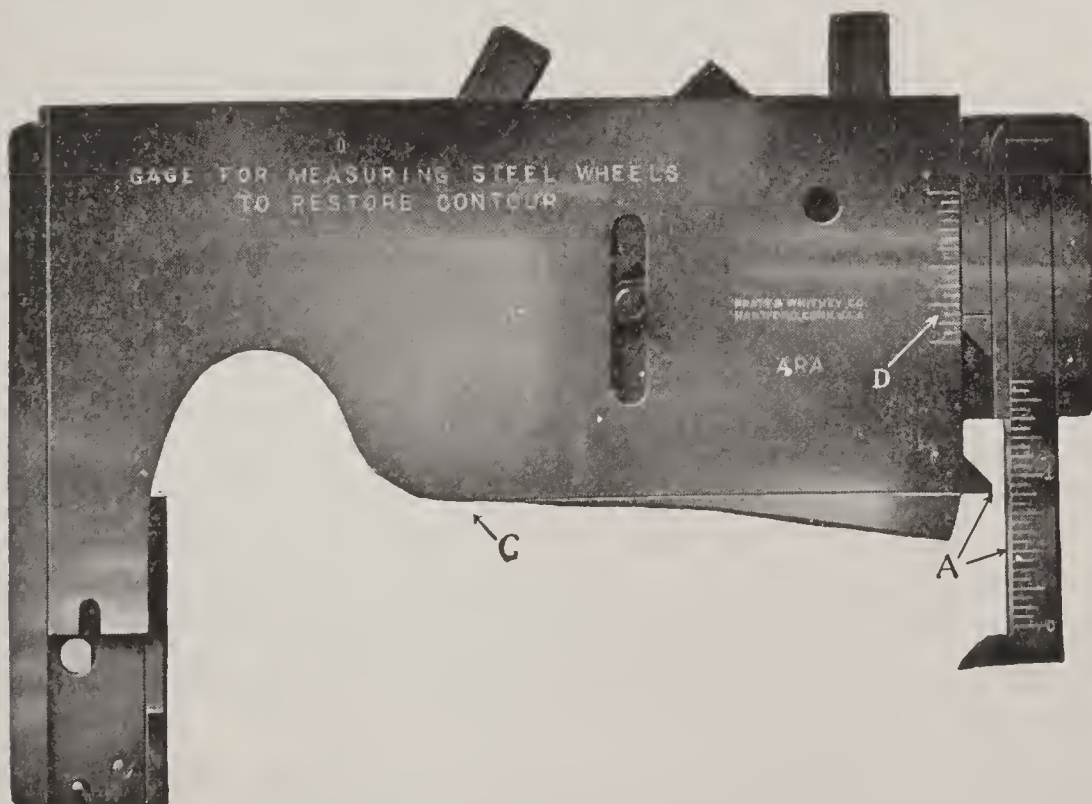


Figure 1

The method of using this gauge is (see Figure 1) to swing pointer A to right. Place gauge over wheel with face B and point C in contact. Swing

A to engage limit or wear groove. Push the four sliding pointers down to the wheel. Remove gauge from wheel. Next (see Figure 2) move sliding



Figure 2

front plate downward until its lower edge coincides with the lowest point of the four sliding pointers. *Scale D* shows that $3/16''$ must be removed at point C to restore standard contour. *Scale A* shows that there will be $7/8''$ of service metal remaining after standard contour has been restored.

Sub-Para. (XIV) MACHINING AND MOUNTING OF WHEELS AND AXLES

In the past insufficient study and care has been devoted to the correct machining and mounting of wheels and axles. Tests conducted by various railroads, universities, and manufacturing concerns have developed surprising results. For instance, it was found that wheels marked of equal tape were as much as $3/16''$ or $1/4''$ off. On a straight track, wheels that are not of the same circumference do not develop much trouble, but when a pair of mismated wheels come to a curve and the big wheel is on the inside it makes a great deal of difference to the wear of the wheels. With $3/8''$ difference in wheels on a 3% curve there is 20% more friction than would have been had the wheels been properly mated. So many other troubles have developed on railroads directly and indirectly as the result of the incorrect mounting of wheels, that some manufacturing concerns have employed experts to do nothing but go around to the different railroads using their wheels, and check and instruct them in the correct mounting of wheels.

In order that we may have a uniform procedure on our road the following is laid down as the result of experience and discussion at our 1921 Staff Meeting and also at the Car Foremen's Association of Chicago. It must be read in conjunction with Chapters 9 and 10 on wheels and axles, respectively.

In handling *cast iron wheels* a close watch should always be kept for the wheel which has a hard hub which almost invariably comes in a low tape measurement. The hub is usually full of blow holes and it is a dangerous wheel to apply and while good judgment should be used unduly hard hub wheels should generally be rejected.

Wheel shop foremen should check the chucks of their boring mills not less than once a month to be sure that the jaws of the chucks are perfectly true. In placing a wheel in the machine the operator should, after closing the chucks, see that he has a five point contact to the **flange of the wheel**. If not, he should examine the wheel for a warped flange.

When boring a cast iron wheel the operator in starting the cut should feed the reamer by hand until the cutter gets properly started. Unless this is done the cutter will tend to follow the bore of the wheel and if the core is out of center and the cutting is begun by jamming the cutters to the wheel and throwing in the feed, the tendency would be to follow the bore, whereas by starting the machine by hand the cut is brought much nearer central although it will not insure it being perfectly true. In taking the second cut what little the wheel is out of true is corrected and for this reason alone it is quite necessary that in boring a cast iron wheel it be done in two operations. The second operation is also intended to give a more accurate axle fit and it has been found that an allowance of six one-thousandths of an inch (varying according to elasticity of wheel) will give the correct pressure when fitting the wheel to the axle. Wheels should be chamfered after making the second cut. Wheels should be bored in pairs, that is to say, two wheels of the same type should be bored for application to the one axle.

The journaling of axles whether new or second hand will consist of the following machining which must be most carefully done:

A roughing cut

A finishing cut with water

Rolling the journal.

The journal should be smooth, perfectly round, and not tapered in any way and the fillets must be smooth.

It is important to consider that good work cannot be done without good tools. Proper shop practice will not permit machinery to be in bad repair. The importance of true and properly fitting lathe centers cannot be overestimated, as during their life axles may be turned on a number of different lathes. If the lathe centers are not true or their angle is not uniform, it will be found impossible to do good work. An instance has been noted where a few axles were about .010" out of round, and an investigation showed that the lathe in which they were turned had centers with an angle of about 85 degrees, which the axles had been centered to 60 degrees. As a result the axle only rested on the lathe center at the end or had a circular line bearing. This line bearing soon wore uneven, allowing the axle to work back and forth, and was responsible for the eccentricity of the axle.

An examination of the centers in axles will frequently show the result of turning on lathe centers of different angles. The axle centers will have the appearance of having been made with a very badly ground centering tool. Some shops are provided with a special grinder designed so that the centers will always be ground on a 60 degree included angle, being thus purposely made to avoid the possibility of setting incorrectly. While the saving due to its use cannot be estimated in dollars and cents, there is no question but that the better work would justify the cost, especially in the larger railroad shops. However, this machine may not always be necessary, but each shop should have center gauges, and these gauges should be frequently tried on centers, and when the latter are found to be incorrect, they should be repaired at once.

Alignment of axle lathes is also a point that does not always receive the attention that should be given. Tapered wheel seats are often obtained on lathes on account of poor alignment and are likely to cause improper fits when mounted with wheels, which are therefore liable to become loose in service. There is also the possibility of the hubs of the wheels bursting when pressing on, and therefore alignment of axle lathes is a matter which should receive the closest possible attention in all shops. The importance of keeping a lathe in alignment can be appreciated when we consider that to mount a steel wheel having a 7" bore or a chilled iron wheel of the same size, the axle must be about .007" and .015", respectively, larger than the wheel bore. Each .001" will affect the mounting pressure about 10 per cent. Wheels have been removed that had a bearing for a part of their length, owing to taper-turned axles, and while the wheels did not come loose in service, it is a condition which, if known to exist, is cause for anxiety. A very satisfactory test for lathes is to take two or three light cuts across the length of the wheel seat and measure the diameters with micrometer calipers.

It has been found that the best results obtain from a smooth fit of the axle. Where a rough fit is used, incorrect tonnage is recorded in pressing on the wheel as the wheel plows down the ridges formed by the tool in making the rough fit and in dismounting the same pair of wheels a very heavy drop in pressure will remove them which is an undesirable condition.

The pressure at which cast iron wheels are to be mounted are as follows:

Axle	Wheel Seat Diameter	Minimum	Maximum
A	5 $\frac{1}{8}$ "	30	45
B	5 $\frac{3}{4}$ "	35	50
C	6 $\frac{1}{2}$ "	40	60
D	7 "	45	65
E	7 $\frac{5}{8}$ "	50	70

These pressures should not be reduced nor exceeded.

At a number of shop points on the system automatic mounting recording gauges are provided and these show correctly not only the pressure exerted in mounting a wheel but also whether there are any defects in the wheel fit. A good fit will show on the record card a perfectly straight line moving upwards and continuing as long as the pressure is on, but erratic

if the fit is uneven or irregular. It is intended ultimately to provide all points with these gages, but until they become available a number of points have to depend upon the ordinary gauge and in this respect it must be understood that where the indicating hand moves back and forth vibrat- ingly between say 50 and 55 tons, the pressure must not be recorded at 55 tons but at a point midway between the highest and lowest point, viz.: 52½ tons.

Before pressing a pair of wheels a good coating of white lead and oil must be painted on the inside of the wheel fit as well as on the axle fit to overcome the danger of the wheel chafing and piling up metal in front of it during mounting, falsifying the mounting pressure and causing the possibility of a loose wheel.

A pair of wheels must be mounted perfectly central otherwise sharp flanges will result and there is a danger of the wheels climbing frogs and leaving the track when operating around curves.

After a pair of wheels is mounted the operator should test the wheels to see they are not crooked on the axle; this is done by tramming on the top and two sides of the wheels before removing them from the wheel press. A three point tramming is always necessary.

The shop foreman must check the mounting operator daily to see that wheels are mounted perfectly central. It is also necessary to check the gauge used for mounting press and see that it conforms with the following dimensions:

Inside gauge of flanges (back to back) Min.....4' 5 $\frac{3}{32}$ "
 Gauge of wheels (face to face) of flanges at point $\frac{5}{8}$ " above base. Nor...4' 7 $\frac{13}{16}$ "
 Check gauge distance (back of one flange to face of other) Max.....4' 6 $\frac{29}{64}$ "

The above dimensions are for all wheels cast since January 1, 1908, and some shops did not change their practice when new rules came out, still following the old, even though there is a difference of 15/64" in distance.

Thicknesses of flanges of wheels fitted on same axle should be equal but must never vary more than 1/16".

Wheels should be mounted to the "check gauge distance" of 4' 6-29/64".

Wheel seats should never be less than limits prescribed, and should be of uniform diameter, smooth and free from ridges, so as to provide a full even bearing of 7".

Prick punching or shimming the wheel fit is not permissible and tapered fits shall not be used.

The mounting of *rolled steel wheels* is the same as for cast iron wheels with the exception that the pressures to be used are:

Axle	Wheel Seat Diameter	Minimum	Maximum
A	5 $\frac{1}{8}$ "	45	60
B	5 $\frac{3}{4}$ "	50	70
C	6 $\frac{1}{2}$ "	60	80
D	7 "	65	85
E	7 $\frac{5}{8}$ "	70	95

When steel wheels are removed from foreign equipment we have to state in connection with our A. R. A. billing how much service metal was in the wheel when removed and how much service metal will be in the wheel after it has come from the lathe. To permit of this information being available before the wheel is actually turned down all shop points have been provided with a special gauge described in sub-para. 13 of this paragraph.

In order to insure accuracy in the use of this gauge all that is necessary in addition to complying with the instructions laid down in connection with the gauge in question is for the machine shop inspector to check correctness of the witness groove. On a 33" rolled steel wheel this should be $29\frac{1}{2}$ " and on a 36" wheel, $32\frac{1}{2}$ ". Provided these measurements are checked and the gauge specially provided is intelligently used, no difficulties should arise in connection with the handling of rolled steel wheels but it should be observed that in turning down our own steel wheels which have a sharp flange on one wheel only it is provided that the *minimum* full flange contour provided by A. R. A. rules will be restored to the wheel turned down to $1/32$ " greater diameter than the mate wheel, which, in turn, will have the *maximum* flange contour allowed by A. R. A. rules provided in the turning down.

In handling *cast steel wheels* the mounting pressures will be the same as for rolled steel wheels and the procedure for boring and mounting the same as already described. When any of these wheels are removed from service on account of sharp flange or flat spots they should be sent to Milwaukee shops to be handled. The flat spots will be corrected or filled up by welding, using a portion of the flange of a discarded wheel to make the weld which has been found to be satisfactory providing the newly applied metal is flattened down with a hammer as added to the wheel. Sharp flange wheels are shipped periodically to the makers, who grind them down for us without charge.

In inspecting *cast iron wheels*, new or second hand, offered by machine shops for service the following must be noted.

Thickness of flange of two wheels on same axle shall not exceed the sum of one normal ($1-15/64$) and one maximum ($1-19/64$) flange or a sum of $2-17/32$ ".

New wheels on same axle must be of same circumference (within $1/8$ " variation) determined by noting tape size. These tape sizes are stencilled in white lead on outerplate and new wheels should occasionally be checked up as to correctness of tape markings to ascertain actual conditions.

Make careful inspection of hub, front and back plates, particularly at core leg hole and chaplets to observe that no cracks obtain due to axle pressure.

Where wheels are mounted on new axles, the axles should conform with the following new dimensions:

Cap.	Dia. Jrnl.	Length Jrnl.	Axle Center	Wheel Seat	Collar	Length over all
40 M	3 $\frac{3}{4}$	7	4 $\frac{1}{4}$	5 $\frac{1}{8}$	$\frac{5}{8}$	6' 11 $\frac{1}{4}$ "
60 M	4 $\frac{1}{4}$	8	4 $\frac{3}{4}$	5 $\frac{3}{4}$	$\frac{5}{8}$	7' 0 $\frac{1}{4}$ "
80 M	5	9	5 $\frac{3}{8}$	6 $\frac{1}{2}$	$\frac{3}{4}$	7' 2 $\frac{1}{2}$ "
100 M	5 $\frac{1}{2}$	10	5 $\frac{7}{8}$	7	$\frac{3}{4}$	7' 4 $\frac{1}{2}$ "
140 M	6	11	6 $\frac{7}{16}$	7 $\frac{5}{8}$	$\frac{7}{8}$	7' 6 $\frac{3}{4}$ "

When inspecting *steel wheels* newly turned and offered by machine shop for service, the following should be checked:

Maximum flange height allowed for new or turned steel wheels.....	1 $\frac{1}{8}$ "
Minimum flange height allowed for new or turned steel wheels.....	1 "
Maximum flange thickness for new or newly turned steel wheels measured $\frac{5}{8}$ " above base line.....	1 $\frac{19}{32}$ "
Normal flange thickness for new or newly turned steel wheels measured $\frac{5}{8}$ " above base line.....	1 $\frac{15}{16}$ "
Minimum flange thickness for new or newly turned steel wheels measured $\frac{5}{8}$ " above base line.....	1 $\frac{11}{16}$ "
Maximum throat radius gauge for steel wheels.....	$\frac{3}{4}$ "
Minimum throat radius gauge for steel wheels.....	$\frac{5}{8}$ "

After mounting wheels a heavy coat of paint or grease should be applied to the journals to prevent them from rusting and when they are loaded for shipment they should again be touched up on the journals with this grease or paint. Wheels must be loaded in such a way that the journals are protected from coming in contact with the next pair of wheels during transit.

Sub-para. (XV)

BRAKE HANGERS

All brake hangers are to be made so as to conform with Specification No. 521-A, copy of which was issued with M. E. Circular Letter 1051.

Sub-para. (XVI)

REMOVAL OF BRAKE SHOES

So that all may know at what stage a brake shoe is considered worn out, the following standards are laid down:

(a) Through Main Line Passenger Trains—Steel back brake shoes on passenger train cars will be held in service until evenly worn to $\frac{7}{8}$ " in thickness. When wear is uneven, brake shoes will be removed when thickness at thinnest point reaches $\frac{3}{4}$ ".

(b) Local or Branch Line Trains—The same as above excepting that limits are respectively $\frac{1}{2}$ " in place of $\frac{7}{8}$ ", and $\frac{3}{8}$ " in place of $\frac{3}{4}$ ".

(c) Freight Trains—Steel back brake shoes and similar designs on cars of government control and other lines must not be scrapped until worn to $\frac{1}{4}$ " in thickness. When the shoe is evenly worn to this thickness, it weighs approximately six pounds.

The steel back brake shoe must not be removed from freight service on account of transverse cracks, as the parts are firmly anchored to the back, which holds them together. Where the cast iron portion of the shoe is cracked and the steel back bent, but not distorted, the shoe must be bent to its original shape and continued in service. Where the steel back is distorted, the shoe must be scrapped.

These standards are general, but local instructions in regard to changing

brake shoes will apply. For instance, at Chicago outgoing Transcontinental passenger trains must have shoes with not less than $1\frac{1}{2}$ " wear, while at Tacoma they must have at least one inch shoe wear.

The practice of reversing shoes wearing more at one end than the other, or of shoes flanged from rim of wheel, is to be discontinued on account of distortion of brake beams resulting from failure to properly mate the shoes on other end of beam. Inspectors should correct a condition where shoe is wearing on rim of wheel, as in addition to undue brake wear resulting, the wheel itself is liable to damage if allowed to continue in this condition.

All brake shoes must be sorted before being scrapped and any shoes that are not worn to condemning limit and are otherwise in serviceable condition, must, be placed back into service.

(See paragraph on brakes for instructions covering the application of new brake shoes to passenger cars having automatic slack adjusters.)

Sub-para. (XVII) EMERY BRAKE CYLINDER LUBRICANT

The "Emery" Brake Cylinder Lubricant will be used hereafter in reclaiming brake cylinder packing leathers and triple valve cylinder cap gaskets, also for the lubrication of cylinders.

All cylinder packing leathers removed on account of porosity should be sent to Milwaukee shops to be reclaimed. However, such leathers as are badly worn or cut should not be sent in for reclamation. Triple valve cylinder cap gaskets to be sent in for reclamation regardless of their condition. Packing leathers and cylinder cap gaskets sent to Milwaukee shops for reclamation must be boxed up carefully so that they will not be damaged enroute and should be shipped to the *Air Brake Shop, Car Department, Milwaukee Shops*. The reclaimed leathers will be shipped out by Store Department on requisition from the various points and are to be used exclusively on system cars inasmuch as A. R. A. rules do not permit making a charge for reclaimed leathers, and we should, therefore, refrain from using on foreign equipment.

When the leathers have been reclaimed, the packing leathers will be put up in packages of twelve and the cylinder cap gaskets in packages of fifty. Each package will be tagged to indicate that the leathers are reclaimed and the outside wrapper will be dated to indicate date on which leathers were reclaimed. It is important that the dates on the packages be observed by the storekeepers in filling requisitions, that is, it is necessary that the oldest date leathers be shipped out in preference to newer dates. This with the view of preventing the reclaimed leathers remaining on the shelves and getting old.

Air brakes shops receiving these leathers will arrange to keep them in a container or wrap them up so that they will not be exposed to the atmosphere, otherwise the filler used in reclaiming the leather will deteriorate.

Brake cylinders on all system equipment including freight cars, passenger cars, miscellaneous equipment, locomotives and tenders, are to be lubricated with the "Emery" lubricant, using just sufficient to coat the

walls of cylinders. A 1 1/4" flat brush is to be used for this purpose. After the cylinder walls have been coated, the expander ring groove is to be filled with the lubricant, except where composition cups are used in which case the groove should not be filled. It is necessary that the utmost care be taken to keep the "Emery" lubricant free from foreign substances, and inasmuch as it will be furnished by Store Department in ten pound containers, there will be no need for keeping a supply of the lubricant in a small bucket. If the containers are not provided with removable covers, a hole should be cut in the top just sufficiently large enough to permit inserting the brush and a piece of tin fastened to the handle of the brush in such way that when the latter is inserted in the container, the tin will form a cover and in that way prevent dirt from getting into the lubricant.

The Store Department at Milwaukee shops will honor requisitions for this material which, as stated, will be put up in ten pound containers. It should be understood by all concerned that no lubricant other than the "Emery" is to be used in connection with the reclaimed packing leathers.

Sub-para. (XVIII)

FINGER GUIDES

In rivetting finger guides to brake beams, it has been found 7" from end of beam to center of rivet hole, brings into a position where best results obtain in service. This will therefore be our standard practice.

Sub-para. (XIX)

COUPLERS

The practice of using small butt end couplers for large yokes, and shimming out between the butt and yoke, is very undesirable. Our standard practice will be to apply couplers with correct sized butt, unless such couplers are absolutely unavailable.

Sub-para. (XX)

**ANTI-CREEPING DEVICE FOR MAJOR
COUPLERS**

A number of cases of couplers parting have recently occurred and investigation develops that this was brought about by the creeping of the lock in the top lift major couplers.

To correct this condition an anti-creeping device or arrangement has been devised for application to this type of coupler, as shown on drawing E-693.

The entire connection complete is to be furnished by the manufacturer, thereby allowing for a quick change. The old type removed to be disposed of as follows:

The lock block to be disconnected from lifting mechanism by punching out the rivet, or cutting off oval link (preferably the former) said lock block to be placed in stock for use on undershot major couplers on cars, relieving any shortage and eliminating the purchase of undershot lock blocks for some time to come.

The old connection from lock block up to be turned in to General Storekeeper who will return same to the manufacturer and receive a reasonable credit for same.

**Sub-para. (XXI) MARKING MINER FRICTION GEARS
WITH DATE APPLIED**

We have a six years' guarantee with the following gears:

Miner A-3-P Friction Draft Gear for Passenger Cars;
Miner A-18-S Friction Draft Gear for Freight Cars;
Miner A-2-S Friction Draft Gear for Freight Cars.

When applying to cars the date of application is to be plainly marked on the gear by means of 1 inch steel stamps. If removed within the guarantee period, gears stamped as described will be marked with white lead, the matter reported to local storekeeper with a request for replacement, and Master Car Builder advised by letter through the usual channels.

Sub-para. (XXII) TENDER SILL STEPS

An accident to an engineman recently occurred due to part of the wooden tread of tender sill step breaking off.

It has been the practice to apply these wooden treads with the grain of the wood running in the direction of the rails.

In renewals these threads are to have the grain of wood running transverse of the rails, for the purpose of prolonging life of tread by lessening liability of surface edge breaking off.

Sub-para. (XXIII) WELDING

Welding plays an important part in the work of repairing equipment, but in order to obtain the maximum results, all concerned must clearly understand that there are certain items on which (a) welding of cracks or fractures is not permitted; (b) building up of surfaces is permitted; and (c) welding cracks or fractures is permitted. The A. R. A. practice is to be followed, and the proceedings in connection therewith are quoted in full:

Autogenous welding limits and regulations: In welding, either by the use of gas or electricity, care and good judgment on the part of the operator are of prime importance. The operator's ability as to the desired proficiency should be certified by the mechanical officers in charge or by an instructor qualified by experience in general railroad welding with the method involved.

The metal added is liable to be porous and relatively brittle.

The heat at the surfaces welded affects other sections near the weld, tending to reduce strength and toughness.

The following general rules must, therefore, be carefully observed:

(a) Welding cracks or fracture will not be permitted on the following:

Axles, arch bars, car wheels or tires, truck equalizers, spring or bolster hangers, brake staffs or wheels, coupler bodies, knuckles, knuckle pins, locks, lifters and throwers.

Parts made of alloy steel or heat treated carbon steel. (Top chord

angles of open top all steel cars if the fracture is located at a point between bolsters more than 5 ft. from the center line of either body bolster.)

(b) Building up worn surfaces will be permissible on the following:

Parts subject to compression only. *Spring or bolster hangers. *Holes in levers. **Center plates Journal boxes. **Truck sides, bolster and column castings.

Coupler bodies, knuckles, locks, lifters and throwers. After building up to the original section, the same must be dressed and then checked with proper gauges to insure interchangeability and proper operation.

Flat spots on rolled steel wheels and tires if thickness of tread is 1" or more above limit of wear groove.

*Provided that the material remaining in part is equal to at least 80 per cent of the original section.

**Provided that the material remaining in part is equal to 60 per cent of the original section.

(c) Welding cracks or fractures will be permitted on the following:

Car and roof sheets. *Cast steel truck sides. *Cast steel bolsters. Draft castings. *Brake beams. *Cast steel coupler yokes. *Pressed and structural steel truck sides, bolster and transoms.

Car sills, posts, braces, stakes, carlines, side plates and end plates.

*Welding is permitted only when the area of the crack is less than 2-5, or 40 per cent, of the total area through the section at the point of fracture, but it is not permissible to weld any crack located within 6" of an old weld.

Regulations for Welding: No parts except truck transoms are to be welded unless removed from car or truck. Truck transoms may be welded in place by removing the truck from under car body.

The edges of pieces for welding must be prepared as shown on pages 198-199 of M. C. B. Proceedings of 1919. If both sides of the fractured member can be worked upon, the fracture should be prepared as per Fig. 1 shown therein, and when only one side of the fractured member is accessible, Fig. 2 should be followed. The entire crack should be burned or chipped out far enough so that there will be no portion of the crack in the metal. Failure to do this permits the check or crack to work its way across the metal to a farther side, due to the constant vibration, even after the weld has been made. A hole may be drilled at the end of crack or check and chipped or burned towards the hole. The surfaces where new material is to be deposited must be clean and bright and reasonably smooth and, therefore, if the surfaces are prepared by the burning process the surfaces must be finished by chipping before welding.

The portion of the part adjacent to the fracture should be heated before the welding is begun. In welding, the operator should begin to weld at the point farthest away from the outside edge and work the weld towards the edge. All efforts must be made to prevent oxidizations, and to ac-

comply with this the work should be placed at angle that will allow the blowing out of all slag or impurities in the fused metal, and by giving the torch a rotary movement it will assist in their removal.

The new material must be deposited to the form shown in Figs. 3 or 4 of M. C. B. Proceedings in order to properly reinforce the weld, and "B" should be somewhat greater than "T." For the important items marked * and ** in division (c), as well as for car sills, posts, braces, stakes, car lines, side plates and end plates, "B" must be at least $1\frac{1}{2}$ times "T."

The parts marked * with the exception of truck transoms welded in place, must be carefully annealed by uniformly heating to approximately 1,400 to 1,500 degrees Fahrenheit and allowed to cool slowly in the atmosphere.

Worn surfaces permitted to be built up to the original section by depositing of new metal thereon must first be made clean, bright and fairly smooth, and after the metal is deposited must be dressed to the required dimensions and gauged where necessary.

When truck side frames and bolsters are welded the weld must be made smooth and the following record legibly stamped on the weld by at least $\frac{3}{8}$ " steel stencils, in the following form:

Month	Day	Year	C. M. & St. P. RR.
Shop	Abbreviation		Welder's number.

Sub-para. (XXIV) WELDING OF LOCK BLOCKS

Great economy can be effected by welding lock blocks, provided the work is properly carried out. Incorrect welding of lock blocks results in break-in-twos in service, leading to severe criticism. The work must be very carefully carried out, seeing (a) that proper fusion of metal is obtained by pre-heating surface to be welded; (b) that bearing surfaces are same distance from each other as on original design, to insure both surfaces being in contact with correspondng surfaces on heel of knuckle, and (c) that bearing surfaces are absolutely vertical.

Proper gauges are obtainable upon application, and every lock block must be gauged before being put into service.

Sub-para. (XXV) RECLAMATION OF MATERIAL

The reclamation of material is a big factor in the operation of the car department.

Where work is carried out under cover, material should at all times be kept in a neat and orderly manner. Where work is done outside as soon as the winter breaks a general clean-up should be made, and all bolts, nuts, and other loose material gathered up and placed in racks. Thereafter throughout the summer months at the close of the week there should be a tidying up, but a systematically worked point will never allow its tracks to become very much encumbered by loose scrap or material. During November there should be a second general clean-up, preparatory to winter, as when snow falls articles such as wrenches, hammers, bolts, etc., are covered

and often lost for the rest of the winter. All waste should be gathered up during these drives, and every possible item, such as broken trucksides, old shoes, odd pieces of broken iron—in fact every loose piece of material of any kind—picked up either on and around the tracks and shops, in the vicinity, or along the right-of-way in the region concerned.

Sub-para. (XXVI) PREVENTING WASTE OF ELECTRICITY

At the exit of every building there is to be a switch, so arranged that when leaving the building the light or lights can be turned out and the place left in darkness.

Sub-para. (XXVII) ECONOMY IN THE USE OF COAL

Many thousands of tons of coal are used annually to provide power, heat and light for the car department. Apart from the elimination of waste at the points of consumption or usage, every effort must be made to conserve coal itself, which is ever increasing in cost. While it is a separate problem for each individual point, it is to be considered a standard practice to be economical in the use of coal.

**Sub-para. (XXVIII) ICING OF CARS CONTAINING
MEATS, PACKING HOUSE
PRODUCTS' ETC.**

These rules must be closely observed in order to prevent heavy claims being presented for spoiled shipments. Straight or mixed cars of fresh and frozen meat or dressed poultry, use crushed ice with salt. Packing house products (butter, eggs, or cheese), must be re-iced with crushed, block or lump ice, with or without salt in accordance with railroad billing.

Ice must be thoroughly cleaned by flushing with water, thus removing all foreign substances to prevent clogging of drains. *Crushed Ice* should be no larger than a man's fist. *Lump Ice* should be broken into chunks of about 15 or 20 pounds weight. *Block Ice* will consist of chunks weighing approximately 50 pounds, which will be permitted to fall into tanks loosely. No. 2 Rock Salt will be used when salt is specified.

Extreme care must be used in the removal of hatch covers and plugs to prevent foreign substances from dropping into tanks. Uncover only such tanks as can immediately be filled, to prevent any unnecessary exposure. Plugs and covers are to be replaced at once after re-icing is completed. Plugs to be fitted evenly and tight in the tanks by tamping lightly with tamping pole.

If tank valves do not work, excess water must be removed from tanks before re-icing is attempted. This can be accomplished by using a hand-pump or bailing out with buckets. Where valves do not work, next icing station must be notified by wire so they can be prepared to promptly remove excess brine before re-icing.

A. R. A. Rule 3 requires all beef refrigerator cars to be equipped with brine retaining valves to prevent brine dripping along right of way between icing stations. When plugs are pulled, excess brine is automatically released. Considering the large number of cars now equipped with this device, and

above rule requiring all such cars to be equipped as fast as possible, it is necessary that each icing station possesses a hand-pump, as excess brine must be removed before re-icing is attempted.

Crushed ice with salt: see that a wooden tamping pole is used. Under no circumstances permit pike poles or poles with metal ends to be used. Tamping pole should be inserted into the old ice—thoroughly stirred—and tamped to settle to bottom of tanks. After tamping, one-third of the salt required in the re-icing is to be properly spread over the old ice before any new ice is used. Then fill tanks completely with ice and put the balance of the salt, evenly spread, on top. Again use tamping pole vigorously to even off the top of the ice and start salt working. See that space between running boards is filled, but do not fill tank above top of saddles.

If station is not equipped with an ice crusher, use wooden mauls and ice crushing boxes to insure efficient re-icing. Under no circumstances permit ice to be broken on roofs or in tanks of cars.

For ready reference use the following table to determine the amount of salt in pounds based on quantity of ice supplied:

Ice Lbs.	5% Salt Lbs.	7% Salt Lbs.	8% Salt Lbs.	10% Salt Lbs.	12% Salt Lbs.	15% Salt Lbs.
500	25	35	40	50	60	75
600	30	42	48	60	72	90
700	35	49	56	70	84	105
800	40	56	64	80	96	120
900	45	63	72	90	108	135
1000	50	70	80	100	120	150
1100	55	77	88	110	132	165
1200	60	84	96	120	144	180
1300	65	91	104	130	156	195
1400	70	98	112	140	168	210
1500	75	105	120	150	180	225
1600	80	112	128	160	192	240
1700	85	119	136	170	204	255
1800	90	126	144	180	216	270
1900	95	133	152	190	228	285
2000	100	140	160	200	240	300
2100	105	147	168	210	252	315
2200	110	154	176	220	264	330
2300	115	161	184	230	276	345
2400	120	168	192	240	288	360
2500	125	175	200	250	300	375
2600	130	182	208	260	312	390
2700	135	189	216	270	324	405
2800	140	196	224	280	336	420
2900	145	203	232	290	348	435
3000	150	210	240	300	360	450

Sub-para. (XXIX)

STORAGE OF PAINT

Whenever it is necessary to store paints, oils or other inflammable material in any type of building whatsoever, the following precautions must be observed:

1. All small containers must be stored on a metal rack constructed according to drawing D-925,

2. All barrels should be mounted on iron skids with sand underneath and all buckets or pails should stand in a trough which has been filled with sand. Wherever possible paint should be removed from wooden containers when received and stored in metal drums.

3. Wherever possible air pressure should be used for agitating our paints and in all cases Molasses Gates should be required for drawing paints and oils from storage containers.

4. No cupboards or lockers or any kind will be permitted within oil or paint storage buildings.

5. All waste must be kept in closed metal containers. This should be watched very carefully on account of the extreme liability of oil waste to ignite and cause very serious damage.

Sub-para. (XXX) CARE OF AIR HAMMERS

At all points where air hammers are used, a wooden tank, lined with zinc, will be provided, with a skeleton wooden partition, so that hammers may be kept therein every night. The tank will be filled with a mixture of three-quarters kerosene and one-quarter signal oil, to a depth so that hammers will be submerged to the head. When beginning work in the morning, hammer will be run for a few minutes before using to drive rivets.

Sub-para. (XXXI) STANDARD METHOD OF PILING BRASSES

Blue-print E-634 issued with M. E. Circular 1074 shows the standard method of piling brasses. Altogether too much carelessness has obtained in the past in the handling of brasses and as a result the linings have become damaged and often times filled with cinders and grit due to the brasses being thrown on to the ground when unloaded from supply cart or truck and then thrown on a hand truck wagon to be taken in to the supply house or store room.

As indicated in the print the brasses are to be piled three in a row, and two rows deep, and the center brass of each row is to have the flange turned toward the inside of row, while the two outside brasses are to have the flanges turned toward the outside, the object is to interlock the pile so as to prevent their tipping over.

Under no condition is a new bearing to be laid inside of another bearing, as this only results in damage to the lining and it is important that the piling of brasses be handled as outlined, as per blue print.

Sub-para. (XXXII) CAB WINDOWS

Many enginemen in the Northern districts where the winters are most severe, have expressed a preference for double frost glass windows over the clear vision window, and the Interstate Commerce Commission has ruled that this is permissible.

As all locomotives operating on the Trans-Missouri, Musselshell, Northern Montana, Superior, Northern, Wisconsin Valley Divisions, and the entire Northern district, pass through the shops for repairs, they should be equipped with the double glass front cab window as is shown on print 15813-E accompanying M. E. Circular Letter No. 189.

Locomotives operating in other districts should be equipped with the standard clear vision window.

**Sub-para. (XXXIII) COVERING FOR LOCOMOTIVE
CABS**

Canvas is being successfully used as a roof covering for passenger cars, and on account of the cost and convenience in applying the practice is to be extended to cab roofs.

Grade "CC" canvas should be used and fastened to roof with fourteen ounce tacks spaced about 1½" apart.

Before applying canvas, roof is to be thoroughly cleaned and given one coat of oil paint. After application the canvas should receive two coats of canvas roofing paint.

**Sub-para. (XXXIV) STANDARD LOCOMOTIVE CAB
NO. 6**

On account of the various designs of cabs formerly applied to the larger classes of system power on the C. M. & G. and C. T. H. & S. E. locomotives, it has been necessary to design a standard cab, as shown on drawing B-27.

This has been done particularly to assist the Store Department in eliminating the great number of repair parts and to reduce the number of types of cabs in service.

Whenever any of the classes of locomotives mentioned on drawing B-27, pass through shop and require new cabs, such cabs will be built to conform to print B-27, using all of the available material from the old cab.

**Sub-para. (XXXV) STANDARD MARKINGS FOR
TENDERS**

The same size and style of lettering and numbering must be used at all points. They must also be applied and maintained in a uniform manner, as shown in blue print 20704-C, issued with M. E. Circular Letter 211. On Southeastern equipment the letters "C. T. H. & S. E." will be substituted for "C. M. & ST. P."

**Sub-para. (XXXVI) PAINTING OF LOCOMOTIVES,
CABS AND TENDERS**

(a) *When locomotives undergo heavy repairs*, the method of painting will be as follows:

All parts are to be cleaned of grease and dirt and wiped clean with kerosene. All new work to be given one coat of metal body filler (lead color).

Jackets, Stack and Arch are to receive one coat of engine finishing black applied with a brush.

Frame, Spring Rigging, Drivers, Pilot and Pilot Truck will be sprayed with one coat engine finishing black to be applied with spraying machine.

Front end of passenger engines are to receive two coats front end paint.

Front end of freight engines are to receive two coats of tar products front end paint.

The whole cab is to be thoroughly washed inside and out. Outside will be sand papered and touched up with dark lead color, new wood primed with mineral primer in oil. When dry putty. Sand paper putty and apply one coat of dark lead color over entire cab. Allow 24 hours to dry and apply one coat of engine finishing black. Letter standard and apply two coats of engine finishing varnish. Allow 24 hours between coats to dry.

On inside new wood will be primed, and bruised parts touched up. When dry apply one coat of engine cab green enamel.

Sash on inside and out will be finished in a like manner to cab.

Immediately after sandblasting tender apply one coat of metal body primer, allow 48 hours to dry and knife in with metal body surfacer, knifing carefully and applying only enough to fill imperfections in the steel. When dry sand paper with emery cloth or sand paper and water. After dry, apply one coat of metal body filler (lead color). Sand paper and apply one coat of flat black, followed by one coat of finishing black. Apply two coats of finishing varnish, allowing 24 hours between coats to dry.

Trucks and frames will be sprayed with one coat of iron black.

Top of Tender is to receive one coat of No. 25 paint.

Any new work done on coal space is to receive one coat of No. 25 paint.

(b) *When locomotives undergo medium repairs*, they will be painted as follows:

The engine proper to receive the same attention as regards painting as for heavy repairs.

Cab is to be washed thoroughly inside and out. Outside sand papered, touched up and puttied. Putty sand papered and touched up with lead color. When dry, whole outside given one coat of engine finishing black. Lettered standard and one or two coats of engine finishing varnish applied, depending on time allowed.

On inside new wood will be primed, and bruised parts touched up. When dry apply one coat of engine cab green enamel.

After washing tender loose paint is to be scraped off, touched up with metal body primer, puttied, sand papered and whole tender given one coat of engine finishing black. Renumber standard and apply one or two coats of engine finishing varnish, depending on time allowed. Where numbers are in good condition and quick job is necessary, cut around numbers with drop black and apply one or two coats of engine finishing varnish.

Frame and trucks are to be sprayed with one coat of iron black.

SECTION V

FACILITIES

Para. 1

GENERAL REVIEW

The general task of providing facilities is outside the province of Car Foremen. It is realized that our facilities are inadequate, and in some cases obsolete, but it is an open question just how far the circumstances of the times will permit our proceeding in the direction of correcting the situation.

In providing and distributing facilities over the system the changing tendencies of car construction have to be very carefully considered, and the ultimate location of any machinery is a matter of considerable study of the railroad situation as a whole.

In the matter of minor facilities, however, all supervisory forces will be responsible for the proper maintenance of existing machinery and tools, so that the fullest possible results may be obtained from their use. The requirements of each point should be the constant study of those in charge, so that when the opportunity arises to renew or add to our facilities, useful and intelligent reports may be rendered quickly. There is a big field for the study of increased output from machines, by their alteration or addition of other parts or by re-location, etc. Enthusiastic foremen will find many items in modern industrial plants, easily applicable to their own repair tracks, and it will be an accepted policy for district general car foremen to afford fair and reasonable opportunities for their foremen to visit industrial plants and shops on our own and other railroads.

Para. 2

UPKEEP

While the providing of facilities is not within the jurisdiction of foremen, the upkeep of existing machinery, tools and buildings is their responsibility. Buildings must be kept well painted, clean, tidy, and free from unnecessary fire risks. Windows must not be allowed to remain with glass broken, but repaired without delay. Nothing tends to make a place look dilapidated more readily than broken dirty windows, or perished and missing putty, and fire hazard is always increased as well. Where stacks from boiler rooms, heating stoves, etc., protrude through roofs, metal flashing must be applied in such a way as to overcome the danger of fire in case of overheating of the stack. Steam air and water leaks must not be tolerated. Delay in repairing such minor items only results in a waste of money to the company.

Under conditions ordinarily pertaining on a fully equipped railroad, it would be sound policy to maintain tools and machinery in good working order, but in our case with barely sufficient to cope with our work, foremen must realize the importance of maintaining every item at its fullest point of efficiency, and take steps accordingly.

Para. 3**STANDARD FACILITIES****Sub-para. (I)****ADVANTAGES**

As with standard materials and standard practices, there are many advantages in adopting standard facilities. As facilities have been provided gradually, little opportunity has presented itself in the past to adopt standards, nor can we afford to scrap facilities in order to provide others of standard design. When replacements are made, however, or even when making repairs and changes, many opportunities will present themselves of standardizing, and this should be done in order to permit of economy by reducing spare parts to a minimum, having them interchangeable, and saving time during changes by having all concerned familiar with machines or tools to be operated or used.

Sub-para. (II)**EMERGENCY TRUCKS FOR PASSENGER
CAR REPAIRS**

Emergency trucks as described under inspection of passenger cars in trains, are maintained at the principal inspection points. In the event of new trucks being required, they will be made strictly in accordance with blue prints, and trucks are in all cases to be maintained fitted in the standard method prescribed.

Sub-para. (III)**WASTE VATS**

Vats 2' 6" x 6' and 22" deep of 1/2" boiler steel, will be used for soaking waste for packing. Variations in arrangement will be permitted in accordance with local requirements. Large points will use two vats—one for passenger car packing and one for freight. Small points will use a vat with a partition dividing it equally.

All points where low temperatures obtain the best results can be secured by carrying the steam piping along immediately below the drain racks, and then boarding in sides of racks to the ground level. This practice should be followed during repairs to any of the present vats. Also at installation or during repairs, vats should be so arranged that they can be drained.

Sub-para. (IV)**TEST RACKS**

Our standard test rack for testing triple valves is the Westinghouse No. 3-T. This will be kept up to date by the replacement of any parts superseded by later designs.

The installation will vary in accordance with local conditions, but is to be put up to best advantage, and maintained in first class condition.

Sub-para. (V)**POWER PLANT PIPE COVERING**

It is required that asbestos pipe lagging be put on pipe tight and smooth, and covered with eight ounce canvas, securing the laps with fish glue. When covering is well smoothed out and all kinks removed, apply one coat of fish glue to entire surface, and when dry apply two coats of fireproof paint. The covering is finally secured by the use of lacquered bands, applied after paint is dry, spaced not more than eighteen inches between centers.

Pipe fittings should be covered by using pulverized asbestos mixed with

water to a soft paste and applied over a wire netting gauge made to fit, covering same with canvas and gluing and painting as mentioned above.

The thickness of pipe covering should be as follows:

Diameter of Pipe:

1" to 5".....	1" thick
5" to 8".....	1 $\frac{1}{8}$ " thick
9" to 10".....	1 $\frac{1}{4}$ " thick
Over 10".....	1 $\frac{1}{2}$ " thick

Sub-para. (VI)

STANDARD TAP DRILLS

Size of Tap	Threads per Inch	Size of Drill
$\frac{1}{4}$	20	$\frac{3}{16}$
$\frac{5}{16}$	18	$\frac{1}{4}$
$\frac{3}{8}$	16	$\frac{9}{32}$
$\frac{7}{16}$	14	$\frac{11}{32}$
$\frac{1}{2}$	13	$\frac{13}{32}$
$\frac{9}{16}$	12	$\frac{15}{32}$
$\frac{5}{8}$	11	$\frac{1}{2}$
$\frac{3}{4}$	10	$\frac{5}{8}$
$\frac{7}{8}$	9	$\frac{3}{4}$
1	8	$\frac{27}{32}$
$1\frac{1}{8}$	7	$\frac{15}{16}$
$1\frac{1}{4}$	7	1- $\frac{3}{32}$
$1\frac{3}{8}$	6	1- $\frac{3}{16}$
$1\frac{1}{2}$	6	1- $\frac{5}{16}$
$1\frac{5}{8}$	5 $\frac{1}{2}$	1- $\frac{13}{32}$
$1\frac{3}{4}$	5	$1\frac{1}{2}$
$1\frac{7}{8}$	5	$1\frac{5}{8}$
2	4 $\frac{1}{2}$	1- $\frac{23}{32}$
$2\frac{1}{4}$	4 $\frac{1}{2}$	1- $\frac{31}{32}$
$2\frac{1}{2}$	4	2- $\frac{3}{16}$
$2\frac{3}{4}$	4	2- $\frac{7}{16}$
3	3 $\frac{1}{2}$	$2\frac{5}{8}$

Sub-para. (VII)

STANDARD PIPE TAPS

Size of Pipe	Threads per Inch	Size of Drill
$\frac{1}{8}$	27	$\frac{11}{32}$
$\frac{1}{4}$	18	$\frac{7}{16}$
$\frac{3}{8}$	18	$\frac{19}{32}$
$\frac{1}{2}$	14	$\frac{3}{4}$
$\frac{3}{4}$	14	$\frac{31}{32}$
1	$1\frac{1}{2}$	1- $\frac{3}{16}$
$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$
$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$
2	$1\frac{1}{2}$	2- $\frac{3}{16}$
$2\frac{1}{2}$	8	2- $\frac{11}{16}$
3	8	3- $\frac{5}{16}$

Sub-para. (VIII)**POWER PRESSES**

A power press is always desirable around a railroad shop, where it can be used to advantage in straightening both car and locomotive parts, pressing bushings in and out, etc., and different types of home-made affairs have been made up of second hand material.

A type that can be cheaply made and which presents desirable features is in successful operation at present, and this is shown on print No. C-545, copies of which will be sent on request.

Section VI

TRAIN OPERATIONS

Para. 1 CO-OPERATION

While the primary function of the car department is to build and repair cars, the operation of the same cars in trains makes it necessary for the closest possible co-operation to be maintained between our department and the department responsible for train operations; success cannot be attained until both of the departments mentioned bend their efforts in the same direction, viz., in producing service. To attain the desired co-operation it is necessary that the officials and subordinates of the transportation department with whom we come in contact, should know something of what is involved in our work, and we in turn must know something of the difficulties with which they have to contend. With this in view it is advisable for all officers above the rank of foreman to be in possession of a copy of the "Rules and Regulations of the Operating Department."

Foremen, inspectors, and carmen will from time to time be asked for information concerning cars, which should be willingly and readily given. The possibility of such information being requested has been borne in mind in the compilation of this book, and in this section certain information is given as much for the instruction of the trainman as for the carman.

Para. 2 CLASSES OF TRAINS

Trains are divided into different classes known as first-class, second class, etc., to meet operating requirements and details can be readily obtained at any depot. The following should be known to all foremen and inspectors:

A "Train" may consist of an engine or motor, or more than one engine or motor, coupled with or without cars displaying markers.

A "Regular Train" is one authorized by a time-table schedule.

A "Section of a Train" obtains when running one or two or more trains on the same schedule, displaying signals or for which signals are displayed.

An "Extra Train" is one not authorized by a time table schedule. It may be designated as "Extra" for any extra train, except work extra; "Work Extra," for work train extra.

It is a rule of this company that a passenger train must not consist of more than 15 cars in any case and inspectors are responsible to the extent of seeing that this is not exceeded.

Para. 3 TIME FREIGHT RUNS

Our daily success as a freight carrying line depends almost entirely on our reputation and ability to keep time freights close to their schedule, and

with this end in view their movements have been specially organized for in the car department. Very much depends on the careful planning of all men along the line, as there is hardly a single city or town of any size on the system which does not receive and supply loaded cars entering into the movement of time freight trains. It is only natural to suppose that the operating department is very anxious at all times to get these trains out of town and on their way as little delay as possible. Foremen will be held responsible to see that cars are properly repaired at loading platforms, industries, etc., bad ordering cars exhibiting serious defects and which cannot be fixed up in time to let them out for movement as intended. If it is possible to prepare cars on repair tracks or train yard for loading at industries, it is the best plan to follow, rather than send men to plants to do this work where they are not properly supervised and where material is often not available. This has been tested and it is found the best plan to fix cars up before they are placed for loading. The same procedure is applicable to coal cars for placing at the mines. Foremen should make such arrangements as to see that these cars, when discovered, are not loaded out, but sent empty to the repair track for attention. It is not a difficult matter to anticipate the movement of loads coming to us from connections, which are to form part of our important time freight runs. Many times these reach us with a lot of delay, which has to be wiped out as shippers keep wiring us for delivery. All that we can do is to see that prompt business-like attention is accorded. It is often very aggravating to have large parts of important trains turned over to us from connections requiring wheel renewals, repairs to air brake equipment, defective trucks and draft rigging. Some of this is due to rough handling through large terminals, or to weak equipment being employed. No loaded cars for important movement destined to points west of Aberdeen on the railroad or east of Seattle are to be allowed to proceed from gateway terminals, unless the following requirements are met (with the exception, that short draft timber cars, if loaded, may be placed to the number of ten per train ahead of the caboose). (a) If draft timbers are used they must extend at least thirty inches behind the center of the bolsters. (b) Cars having steel center sills running from end to end of car are satisfactory. (c) Cars of steel underframe, steel framed or all metal construction are satisfactory. (d) Cars having short draft timbers in front of body bolsters must have the load transferred at gateway terminals and if possible, the car is to be disposed of to the delivering line in a satisfactory manner, unless it is known that the car can be kept not more than ten cars ahead of the caboose for the entire movement.

Para. 4

WORK TRAINS

Proper co-operation and understanding with the operating department will do ever so much in providing for successful operation of work, gravel and ballast trains. Sufficient notice should be given in advance, so that opportunity may be taken to put cars in shape. Care should also be exercised to be certain that the proper type of car is furnished; for instance, ballast cars should not be used where flat cars are wanted, resulting in the sides of ballast cars being torn off and wrecked as has been done so often

in the past. Proper distribution of lading is something which must be considered in this service. Too often, all of the load is placed at one end or in the center, resulting in permanent distress and breakage of car frame. Center plates should be well lubricated, side bearings free of each other, draft gear, brakes and wheels in good order, and lubrication, packing brasses, wedges, boxes, covers and dust guards in perfect condition to render effective service. Overloading of cars is to be avoided. In returning ballast cars to revenue service in the fall sufficient time is to be allowed so that we can locate end gates and be prepared to remove and store the metal aprons. General car foremen must watch this, otherwise the equipment is liable to stand around waiting for action and failing to this extent from earning revenue.

Para. 5

STOCK TRAINS

Certain sections of the railroad depend very materially, or in a large part, on our ability to attract stockmen to ship over our lines. Very certain and difficult competition has to be met. Besides this, one of the greatest opportunities offered for damage claims is accounted for from delay in getting stock to market on time, resulting in changing prices offered for stock at the primary markets, also delays mean extra feeds which burden the shipper with unwarranted expense. Defective equipment placed for loading should always be avoided as there is plenty of time to fix stock cars properly during the idle season and at feeding stations, where they must necessarily lay five hours at least. This is a branch of the trade where we must deliver service every minute as the shipper has his representative on board to check us up.

Stock originating west of Highwood on the Northern Montana and west of Three Forks on the main line, is moved to Miles City for feeding, this in view of it being impossible to bring stock from these points into Marmarth without violating the 36-hour law. This stock then moves through Mobridge, Montevideo, Farmington, River division, La Crosse division and C. & M. division, having a feed again at Montevideo.

Stock originating on the S. M. division and branches moves over the La Crosse division and the C. & M. division.

Stock originating on the I. & D. division moves over that division, Dubuque division and Illinois division.

Stock from points on the S. C. D. division, K. C. division and Iowa division, moves over these divisions and the Illinois division into Chicago.

Stock for movement from Texas for points on Western Lines is moved over the S. C. & D. division to Mobridge and then to destination, and it has been arranged that this stock, which comes to us in very weakened condition, is to be unloaded, rested, fed and inspected at Sioux City before being routed over our line in system cars. Foreign cars, as a general practice will be returned to delivering line, so that it is not only necessary to have a sufficient supply of fit cars at Sioux City during such periods, but also to see that the shipments are handled with dispatch and care. Steel under-

frame and metal framed stock cars of foreign ownership are not desirable, due to their tendency to derail, for movement on our branch lines, especially out of Mobridge.

The Federal Law prohibits the movement of stock when such movement exceeds 36 hours, unless stock is unloaded for rest and feeding. It is therefore, of the utmost importance, that stock cars be given the best attention at originating stations and at feeding stations, so that the trains will be able to make their next stop without being delayed on account of defective equipment. The minimum layover at feeding stations is five (5) hours.

Movement of stock trains are checked by government representatives, and in cases where the 36-hour law is violated, suits are brought against the road.

In explaining the primary movements, it is to be stated, that the principal packing houses on the railroad are located at Seattle, Spokane, Aberdeen, So. St. Paul, Milwaukee, Sioux City, Austin, Cedar Rapids, Ottumwa, Omaha, Kansas City and Chicago, so that primary movements will find their way to these stations, and local car foremen are well acquainted with the necessities of the case and must not only take into account movements which come to them from their neighboring foremen, but should take sufficient interest to see that when our cars are returned that they go into the loading territories in good order, and in this sense they can control their bad order situation and difficulties of movement through their territory to a very great extent.

It is meant in this that foreman must not complain about their neighbors when they themselves had the same empty stock cars passing through their stations prior to being loaded, but failed to fix them with the result they again had them on their hands under revenue load in defective condition, necessitating delay to trains and often transfer of shipments. Further emphasis is necessary to point out that shippers are unwilling to delay their stock and to go to the additional expense of extra feeds, which can be overcome if we put these trains in shape in the five hours allowed us during the rest period. This must be done on repair tracks at feeding stations, which are primarily responsible for the 36-hour movement of trains between feeding stations and to consuming markets.

Para. 6 LOGGING, LUMBER, ICE AND ORE TRAINS

This type of train movement is more or less localized and yet so important, if we are to maintain the good will and necessarily the patronage of communities we serve. The requirements of service at the various points on the system are well known to local foremen. An active effort is absolutely essential and must be made at all times to keep the equipment in good shape to handle the business offered and avoid delays and disaster. Equipment in such service must be given periodical attention.

Side bearing clearance must be watched on cars for logging, and side sills must be in condition to carry side stakes. Steel underframe equipment

will not be used for ice loading, and wheels of ore cars will be given especially careful attention.

Para. 7 MEAT, FRUIT, PRODUCE AND DAIRY TRAINS

Possibly our greatest problem in the movement of scheduled freight runs comes under these classifications. In the first place, the equipment going to make up these trains experiences more mileage than any other type, as it is kept in constant service and this has a very definite effect on the ability of truck frames, wheels, and axles to withstand breakage due to fatigue of metal. Boxes run hot due to high speed maintained and the rocking loaded, especially in beef cars, which, coupled with heavy superstructures, imposes tremendous strains on the running gear. The greatest possible temptation prevails to absorb lost time, often with disastrous results, for most of the shipments are of a very perishable nature, and time is consumed not only in icing enroute but for distances such as California to New York in fruit runs, it is reasonable to suppose that many unforeseen conditions have to be met, not only operating, but mechanical and climatic. Experience has dictated a policy of starting the trains out in the best possible condition, all necessary repairs being made at intermediate points; also where time will not allow giving proper attention to defects, good judgment will probably dictate the cutting out of the car, and this must be done rather than take any chances. A careful check must be made to see that equipment in this service is not overloaded. Our greatest pride should be centered in handling the difficult class of business promptly, successfully and safely. Wherever it can be arranged, cars must be gone over before being set for loading or at time loading is going on. Careful attention should be given hatch plugs to see that they fit properly top and bottom so as to insure the proper insulating qualities for the car. Ice racks in the bottom of ice bunkers are to be maintained in good order so as to prevent injury to ice pans.

Para. 8 STEEL TRAINS, SILK RUNS, AND TRANS-CONTINENTAL TRAINS

It often happens that we have special runs lasting for long periods, of commodities destined for export at the Pacific Coast, or imports coming to us from the Orient, Alaska and other parts of the world. These shipments are only maintained on the railroad to the extent of our being able to render better service to that of our neighbors. The secret of success in the handling of such movements is to first know the characteristics and requirements of the service and to put the equipment in proper condition to start with, so that it can make a successful run to its destination without a lot of delay intermediately due to defects which should have been initially discovered.

Public attention is often focused upon the performance of these trains, on account of advertisements in connection with their contents, and for this reason it is very important that the equipment be in first class shape before loading, so as to exclude the possibility of accident and heavy losses

due to fast running of defective cars. Inspectors at intermediate points should never forsake the factor of safety in attempting to help keep a train on time.

Para. 9 LOCATION OF CARS IN TRAINS

It is of the greatest importance that the weak constructed cars be hauled at the rear end of trains and all points will make it a policy to constantly request this being done and will quote Operating Rule No. 988, shown on Page 123 of "Rules and Regulations," which rule is quoted for information:

"The following cars, loaded or empty, will be handled next ahead of the caboose, giving preference in the order shown, except that at least one car must be handled between a flat car loaded with rails and the caboose:

1. Bad order cars.
2. All wood flat cars.
3. Coal cars with temporary sides.
4. Oil tanks, except all steel or steel underframes."

In all trains more than 65 cars in length, cars with short draft timbers should be switched to the rear. Cars with short draft timbers must not be allowed in a westward direction beyond Harlowton, and in so far as possible they should be cut out at Mobridge and at that point switched and returned east, with the exception of sufficient cars to fill requirements in handling coal from the mines around Roundup and eastern points. No cars with short draft timbers should be allowed at the mines with coal designated to points west—only to points east. Cars for Pacific coast points are to be of metal underframe and draft sill construction in order to withstand the severe service conditions encountered.

Para. 10 LOAD LIMITS FOR CARS

So many differences of opinion exist as to the carrying capacity of cars that the following table has been worked up based on the total journal capacity of cars. This means that provided all other parts of the car are capable of bearing the load, the car may be safely loaded to the capacity shown provided the weight is distributed in accordance with A. R. A. loading rules.

The method of arriving at the carrying capacity of a car based on total journal capacity is to take the collective carrying capacity of the axles less the light-weight of the car. However, the light-weight of the car must not include the weight of the wheels and axles themselves as wheels and axles do not rest or bear on the journal of the axle and their weight consequently does not have to be borne as the rest of the car has. The following tables show the weight of axles as well as their carrying capacity:

Size	Weight	Carrying Capacity
3¾" x 7"	414 lbs.	15,000 lbs.
4¼" x 8"	519 lbs.	22,000 lbs.
5 " x 9"	689 lbs.	31,000 lbs.
5½" x 10"	825 lbs.	38,000 lbs.
6 " x 11"	1,002 lbs.	50,000 lbs.

The following weights for 33'' wheels are for information:

Material	Size of Journal	Car to which applied	Weight of each
Cast Iron	3¾" x 7"	40 M	625 lbs.
Cast Iron	4¼" x 8"	60 M	650 lbs.
Cast Steel	4¼" x 8"	60 M	600 lbs.
Rolled Steel	4¼" x 8"	60 M	650 lbs.
Cast Iron	5 " x 9"	80 M	675 lbs.
Cast Steel	5 " x 9"	80 M	620 lbs.
Rolled Steel	5 " x 9"	80 M	710 lbs.
Cast Iron	5½" x 10"	100 M	725/750 lbs.
Cast Steel	5½" x 10"	100 M	630 lbs.
Rolled Steel	5½" x 10"	100 M	760 lbs.
Cast Iron	6 " x 11"	140 M	850 lbs.
Cast Steel	6 " x 11"	140 M	650 lbs.
Rolled Steel	6 " x 11"	140 M	805 lbs.

Table No. 1—Cars equipped with trucks having 3¾" x 7" journals, stencilled capacity of car being 40,000 lbs., (no overload permitted).

Allowable Limited		Allowable Limited		Allowable Limited	
Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity
20,000 lbs.....	46,656 lbs.	26,000 lbs.....	40,656 lbs.	31,000 lbs.....	35,656 lbs.
21,000 lbs.....	45,656 lbs.	27,000 lbs.....	39,656 lbs.	32,000 lbs.....	34,656 lbs.
22,000 lbs.....	44,656 lbs.	28,000 lbs.....	38,656 lbs.	33,000 lbs.....	33,656 lbs.
23,000 lbs.....	43,656 lbs.	29,000 lbs.....	37,656 lbs.	34,000 lbs.....	32,656 lbs.
24,000 lbs.....	43,656 lbs.	30,000 lbs.....	36,656 lbs.	35,000 lbs.....	31,656 lbs.
25,000 lbs.....	41,656 lbs.				

Table No. 2—Cars equipped with trucks having 4¼" x 8" journals, stencilled capacity of car being 60,000 lbs., subject to 10% overload.

Allowable Limited		Allowable Limited		Allowable Limited	
Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity
25,000 lbs.....	70,076 lbs.	36,000 lbs.....	59,076 lbs.	46,000 lbs.....	49,076 lbs.
26,000 lbs.....	69,076 lbs.	37,000 lbs.....	58,076 lbs.	47,000 lbs.....	48,076 lbs.
27,000 lbs.....	68,076 lbs.	38,000 lbs.....	57,076 lbs.	48,000 lbs.....	47,076 lbs.
28,000 lbs.....	67,076 lbs.	39,000 lbs.....	56,076 lbs.	49,000 lbs.....	46,076 lbs.
29,000 lbs.....	66,076 lbs.	40,000 lbs.....	55,076 lbs.	50,000 lbs.....	45,076 lbs.
30,000 lbs.....	65,076 lbs.	41,000 lbs.....	54,076 lbs.	51,000 lbs.....	44,076 lbs.
31,000 lbs.....	64,076 lbs.	42,000 lbs.....	53,076 lbs.	52,000 lbs.....	43,076 lbs.
32,000 lbs.....	63,076 lbs.	43,000 lbs.....	52,076 lbs.	53,000 lbs.....	42,076 lbs.
33,000 lbs.....	62,076 lbs.	44,000 lbs.....	51,076 lbs.	54,000 lbs.....	41,076 lbs.
34,000 lbs.....	61,076 lbs.	45,000 lbs.....	50,076 lbs.	55,000 lbs.....	40,076 lbs.
35,000 lbs.....	60,076 lbs.				

Table No. 3—Cars equipped with trucks having 5" x 9" journals, stencilled capacity of car being 80,000 lbs., subject to 10% overload for closed types, and 15% overload for open types.

Allowable Limited		Allowable Limited		Allowable Limited	
Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity
25,000 lbs....	107,156 lbs.	37,000 lbs....	95,156 lbs.	49,000 lbs....	83,156 lbs.
26,000 lbs....	106,156 lbs.	38,000 lbs....	94,156 lbs.	50,000 lbs....	82,156 lbs.
27,000 lbs....	105,156 lbs.	39,000 lbs....	93,156 lbs.	51,000 lbs....	81,156 lbs.
28,000 lbs....	104,156 lbs.	40,000 lbs....	92,156 lbs.	52,000 lbs....	80,156 lbs.
29,000 lbs....	103,156 lbs.	41,000 lbs....	91,156 lbs.	53,000 lbs....	79,156 lbs.
30,000 lbs....	102,156 lbs.	42,000 lbs....	90,156 lbs.	54,000 lbs....	78,156 lbs.
31,000 lbs....	101,156 lbs.	43,000 lbs....	89,156 lbs.	55,000 lbs....	77,156 lbs.
32,000 lbs....	100,156 lbs.	44,000 lbs....	88,156 lbs.	56,000 lbs....	76,156 lbs.
33,000 lbs....	99,156 lbs.	45,000 lbs....	87,156 lbs.	57,000 lbs....	75,156 lbs.
34,000 lbs....	98,156 lbs.	46,000 lbs....	86,156 lbs.	58,000 lbs....	74,156 lbs.
35,000 lbs....	97,156 lbs.	47,000 lbs....	85,156 lbs.	59,000 lbs....	73,156 lbs.
36,000 lbs....	96,156 lbs.	48,000 lbs....	84,156 lbs.	60,000 lbs....	72,156 lbs.

Table No. 4—Cars equipped with trucks having 5½" x 10" journals, stenciled capacity of car being 100,000 lbs., subject to 15% overload for closed types, and 20% overload for open types.

Allowable Limited		Allowable Limited		Allowable Limited	
Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity
30,000 lbs....	131,100 lbs.	41,000 lbs....	120,100 lbs.	51,000 lbs....	110,100 lbs.
31,000 lbs....	130,100 lbs.	42,000 lbs....	119,100 lbs.	52,000 lbs....	109,100 lbs.
32,000 lbs....	129,100 lbs.	43,000 lbs....	118,100 lbs.	53,000 lbs....	108,100 lbs.
33,000 lbs....	128,100 lbs.	44,000 lbs....	117,100 lbs.	54,000 lbs....	107,100 lbs.
34,000 lbs....	127,100 lbs.	45,000 lbs....	116,100 lbs.	55,000 lbs....	106,100 lbs.
35,000 lbs....	126,100 lbs.	46,000 lbs....	115,100 lbs.	56,000 lbs....	105,100 lbs.
36,000 lbs....	125,100 lbs.	47,000 lbs....	114,100 lbs.	57,000 lbs....	104,100 lbs.
37,000 lbs....	124,100 lbs.	48,000 lbs....	113,100 lbs.	58,000 lbs....	103,100 lbs.
38,000 lbs....	123,100 lbs.	49,000 lbs....	112,100 lbs.	59,000 lbs....	102,100 lbs.
39,000 lbs....	122,100 lbs.	50,000 lbs....	111,100 lbs.	60,000 lbs....	101,100 lbs.
40,000 lbs....	121,100 lbs.				

Table No. 5—Cars equipped with trucks having 6" x 11" journals, stencilled capacity of car being 140,000 lbs., subject to 15% overload for closed types, and 20% for open types.

Allowable Limited		Allowable Limited		Allowable Limited	
Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity	Light Weight of Car	Load Based on Total Journal Capacity
36,000 lbs....	174,808 lbs.	54,000 lbs....	156,808 lbs.	72,000 lbs....	138,808 lbs.
37,000 lbs....	173,808 lbs.	55,000 lbs....	155,808 lbs.	73,000 lbs....	137,808 lbs.
38,000 lbs....	172,808 lbs.	56,000 lbs....	154,808 lbs.	74,000 lbs....	136,808 lbs.
39,000 lbs....	171,808 lbs.	57,000 lbs....	153,808 lbs.	75,000 lbs....	135,808 lbs.
40,000 lbs....	170,808 lbs.	58,000 lbs....	152,808 lbs.	76,000 lbs....	134,808 lbs.
41,000 lbs....	169,808 lbs.	59,000 lbs....	151,808 lbs.	77,000 lbs....	133,808 lbs.
42,000 lbs....	168,808 lbs.	60,000 lbs....	150,808 lbs.	78,000 lbs....	132,808 lbs.
43,000 lbs....	167,808 lbs.	61,000 lbs....	149,808 lbs.	79,000 lbs....	131,808 lbs.
44,000 lbs....	166,808 lbs.	62,000 lbs....	148,808 lbs.	80,000 lbs....	130,808 lbs.
45,000 lbs....	165,808 lbs.	63,000 lbs....	147,808 lbs.	81,000 lbs....	129,808 lbs.
46,000 lbs....	164,808 lbs.	64,000 lbs....	146,808 lbs.	82,000 lbs....	128,808 lbs.
47,000 lbs....	163,808 lbs.	65,000 lbs....	145,808 lbs.	83,000 lbs....	127,808 lbs.
48,000 lbs....	162,808 lbs.	66,000 lbs....	144,808 lbs.	84,000 lbs....	126,808 lbs.
49,000 lbs....	161,808 lbs.	67,000 lbs....	143,808 lbs.	85,000 lbs....	125,808 lbs.
50,000 lbs....	160,808 lbs.	68,000 lbs....	142,808 lbs.	86,000 lbs....	124,808 lbs.
51,000 lbs....	159,808 lbs.	69,000 lbs....	141,808 lbs.	87,000 lbs....	123,808 lbs.
52,000 lbs....	158,808 lbs.	70,000 lbs....	140,808 lbs.	88,000 lbs....	122,808 lbs.
53,000 lbs....	157,808 lbs.	71,000 lbs....	139,808 lbs.		

The allowable limits quoted *do not* include permissible percentage of overload.

Para. 11**MISCELLANEOUS**

There are many minor directions in which we can help the operating department and in which they can assist us, and some of these are mentioned herein. One is by avoiding switching defective cars in conjunction with good serviceable cars. Unless this is done the bad-order car, unable to stand the physical stress imposed, generally reaches the repair tracks in such a condition as to necessitate much more work than would have been necessary had it been switched independently. Another point is, that some train crews are in the habit of carrying switch chains on truss rods under caboose and car equipment. This is a very bad and dangerous practice and where observed by inspectors must be stopped. If chains are necessary they must be placed inside the car.

We are at some periods of the year very hardly pressed to provide equipment to meet demands for cars for the movement of certain commodities such as grain, flour, etc. Very often there is no general shortage of cars but merely a heavy demand for the one particular class of equipment, and it is very annoying to observe cars entirely suited for the lading in question being used unnecessarily for hauling commodities which could easily be handled in a class of equipment of which there is an abundance available. Foremen and inspectors will, whenever they see cars being misused in this way, make a note of the fact and draw the attention of operating officials to the matter in such a way that good and not friction will result from it. In making a note of such cars, it is advisable to do so in a book so that periodical reports can be called for should there be any prevalence of this misuse of cars at any time. In order to make the information useful the waybill reference should be recorded also.

In the same way, we should at all times endeavor to prevent the use of steel underframe equipment for ice loading, and inspectors are warned they are not to allocate steel underframe cars to this service without express permission through their foremen from the Master Car Builder. Refrigerator cars equipped with ice boxes positively must not be used for ice loading.

In connection with the turning back of cars with short draft arms or of weak construction, the operating department has issued instructions that cars marked "WC" (for Lines East) or "SR" (for Lines West) will not be hauled westward beyond Aberdeen. All concerned will mark cars accordingly when operating in the regions affected.

In all train yards, car inspectors are responsible for the closing of side doors on all cars other than those loaded at the freight house. Many serious accidents have occurred through negligence of this instruction, and it has been a matter of doubt as to whose responsibility it was. It is now our responsibility. This applies to box cars, refrigerators and all house cars and vigorous action must be taken by foremen to see that the instruction is carried out both in the interest of safety and economy.

Another matter where we should link up with the operating department is in the mishandling of cars in switching. When it is observed that a car is rough handled notation should be made of it and the matter reported

through direct channels to the superintendent so that he may take steps to correct the matter.

When sleepers are set out soil cans must be placed under them and foremen will not wait until this matter is neglected and reported through this office to take steps to obtain cans, should there be a shortage, but will look after this matter as one of routine and see that complaints do not arise.

When baggage cars are to be loaded with theatrical equipment, inspectors will see that all oil is removed from the lamps, and lamps are wiped dry so as to guard against claims which have arisen from this cause in the past.

When passenger trains leave coach yards to back into depots, the back-up hose must be coupled to the brake pipe by the carman who will see that the air is cut in and ready for service and the hose hung in a manner which will insure against its falling off.

Para. 12 OBSERVATION OF CONDITIONS

There is no more practical way of determining the conditions prevailing on a railroad than by actual observation. Foremen should occasionally post themselves a few miles outside of a terminal or at some similar point, and note the condition of cars. In this way excessive draft gear slack, flat wheels, hot boxes, improper brake adjustments, missing parts of trucks, etc., can be readily observed, as well as the loading of cars and way in which train is handled. Also switching yards should be visited and the way in which trains are made up noted. There is an unlimited field for observation, and much good will generally result from foremen being acquainted first hand with the conditions he has to contend with in his work of keeping cars in proper condition.

Section VII

WRECKING

Para. 1

GENERAL OUTLINE

Wrecks form a regrettable side of railroading. In spite of all the care and devotion that can be bestowed upon tracks and equipment, the forces of nature—wind, rain, snow, temperature, lightning, etc.—can ever upset the most careful calculations of man, and wrecks result. Realization of this fact is the reason why we prepare to meet such contingencies, and in consequence the “Wrecker” has been evolved.

The wrecking outfit is to the railroad what the fire brigade is to a city, and absolute efficiency is the only permissible basis for its operation. Any breakdown, delay, or ineffectiveness may cause the suffering and inconvenience of passengers, and will almost assuredly result in financial loss to the company.

No definite rules can be laid down as to the method of handling wrecks nor what is required for the preparation in connection with them, and the following rules are for general guidance only, discretion and good judgment being used by those responsible.

Para. 2

CAUSES OF WRECKS

Sub-para. (I)

COMBINATIONS OF CONDITIONS

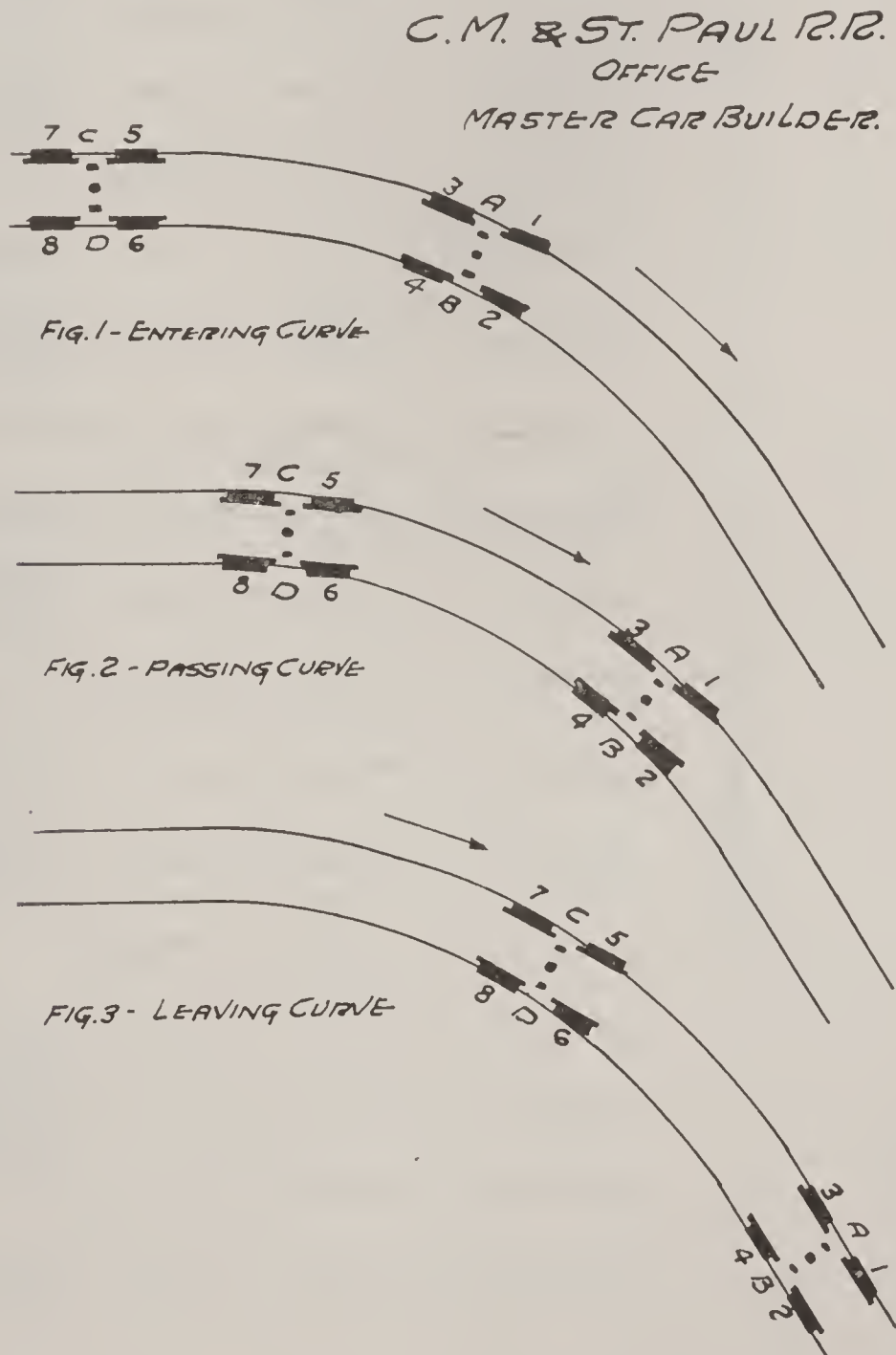
Investigations of wrecks are often more or less perfunctory, and sometimes resolve themselves into a means of the various departments saddling the blame on to someone else, and clearing their own records. This leads to two things, carelessness in ascertaining and correcting the factors which contribute to wrecks, and friction which destroys harmony whose value cannot be estimated in dollars and cents, but which is nevertheless one of the most valuable assets in economical operation.

It will be the policy of this department to be perfectly frank and fair in assigning causes of wrecks, and where due to a combination of conditions, to state all the conditions, regardless of whether they represent the responsibility of another department, or if they are solely our own. It is not sufficient to say that because the load shifted, the trucks were defective, the flanges sharp, or the car did not slue, the roadway is absolved, but it must first be brought out that the same accident would have occurred under perfect conditions of the line, surface, elevations, etc. To say that a piece of track put up well enough for cars in average condition to operate safely does not free us from responsibility when a car below the average is derailed, provided that if the track had been a little better, the accident would not have occurred. A switch may be sufficiently well adjusted to permit a thousand old cars to pass over it with perfect safety, but if one of the thousand with a flange sharper than it should be, picks the point, it should not be credited with all the blame—some of it belongs to the roadway department.

Sub-para. (II) **WHEEL FLANGE AND TREAD DEFECTS, SIDE BEARINGS AND RIGID TRUCKS**

Derailments due to the dropping of brake beams, defective material, broken parts, inoperative brakes, worn or slid flat wheels, broken springs, etc., will, of course, occur to some extent under any conditions, and the remedy in each case is well known.

Sketch herein shows the position of freight car trucks on different parts of curves. In the first instance is represented a car entering the curve; in the second one, passing the curve, and in the last, leaving the curve.



As you know, the outer rail on a curve is elevated so that at a certain critical speed the centrifugal force is balanced and the load on all four wheels is equalized. The speed under which this condition takes place will be designated as normal speed. When a car is operating over the curve at the normal speed, the load is carried on the center plates and the trucks are free to swivel. If the speed is greater than normal, the car will tilt outward,

POSITION OF FREIGHT CAR TRUCKS ON DIFFERENT PARTS OF CURVE, AND TABLE.

SKETCH N^o 1249-1

[illegible]

and if it is less than normal, the car will tilt inward. In both of these cases the side bearings toward which the car body tilts assists the center plates in carrying the weight of the car body. This pressure on the side bearings grips the truck, and in some instances is great enough to prevent it from swiveling without excessive flange pressure.

When a car enters a curve, the front truck being on a partially elevated track and the rear one on a level track, it is subject to a severe twist, and if the framing is rigid, as it is in the case of most of our new high-capacity steel underframe and all-steel cars, the load is carried by two side bearings diagonally opposite each other. This is not so true of passenger cars because they have two sets of springs in tandem and the body is long and therefore more or less flexible. On freight cars and tenders, however, where the distance between truck centers is comparatively short, this holds true and causes difficulty.

When entering a curve, if the car frame and springs are sufficiently flexible, the load will be equal on all of the wheels if the car approaches at normal speed. The truck will, therefore, be free to swing and the wheel designated as No. 1 in Figure 1 will serve as the only point of flange being in contact with the rail and will not rack under a severe thrust and therefore the danger of its climbing the rail will stand at a minimum. On the other hand, if the car frame is rigid, the whole load will rest on the side bearings designated as A and D, thus gripping the trucks and causing a heavy pressure between the wheel flanges and the rails, and the only reason that the wheels will not climb in their efforts to swivel the trucks is because of the excessive vertical load which comes on them.

When entering a curve at high speed the car will list to the outside, gripping the truck proportionately to the speed, but also holding down wheel marked No. 1 with proportionately greater vertical load. The pressure between the rail and the wheel flanges is, however, increased by an additional item which unfortunately does not add anything to the load on the wheel itself—it takes more force to deflect the momentum of the truck. The danger at wheel marked No. 1 is therefore greater than when operating at normal speed. If in addition to this condition the car has a rigid steel underframe or superstructure, and the load rests on only two points, it is clear that the danger will be still greater, although there will be a heavier vertical load resting on the wheels in question. On the other hand, should the car enter a curve at lower speed than the normal, it will list inward, gripping the track at the inside side bearing, causing wheel No. 1 to hug the rail and resist the swiveling of the truck, which causes a high pressure between the rail and the flange. Under this condition there is very little vertical load on the wheel, and following the path of least resistance the tendency will be to climb the rail. If the car has a rigid frame and superstructure, the vertical load on wheel No. 1 will be increased and the tendency to climb the rail will thus be largely overcome. In other words, there is less tendency for a car with a rigid frame to be derailed when entering a curve at slow speed than there is with one having a flexible framing. This conclusion is borne out by actual experience.

In passing along a curve at normal speed, the conditions on both of the trucks are practically the same, that is, wheels 1 and 5 hug the rail, while the others do not, and as there is no tendency for further swiveling of the truck, it makes no difference whether the car frame is rigid or flexible. Under normal speed the loads on all of the wheels are the same and the trucks are free to swivel because the body of the car is free from

the side bearings. There is, therefore, little danger from the wheels climbing.

At high speeds the car lists outward, gripping the truck at the side bearings and pressing wheels No. 1 and 5 heavily against the rails. Since there is a considerable vertical load on these wheels, there is generally no danger of derailment unless other imperfections come into play.

At slow speeds the car will list inward, owing to the elevation of the rail and will grip the truck solidly, this in turn pressing the wheels marked No. 1 and 5 hard against the rail. At the same time, there is little, if any, vertical load to hold these wheels down and derailments are often caused in this way.

On leaving a curve at normal speed, wheel No. 5 only hugs the rail and the trucks are both free to swivel. With a rigid car body and superstructure, however, the load is partly carried on two side bearings diagonally opposite each other because of the front truck being on level track and the rear one on that part of the track with one rail elevated, but fortunately a fair share of the vertical load is obtainable to hold the wheels in place and avoid their climbing the rails.

At high speed the rear truck is gripped through the vertical pressure coming down on the side bearings, but the front truck is free. The rear truck will thus derail easier than the front one and this, as you well know, has been borne out by many practical experiences. With a rigid underframe and superstructure, the relative positions remain about the same with the exception, however, that the diagonal loading of the side bearing, adds to the already strained conditions.

In leaving a curve at low speed and assuming that the car frame is fairly flexible, all of the wheel flanges on the front truck are free of the rail. With a rigid car, however, the diagonal loading will grip the truck and hold it in the same relative position as with the car on the curve. Wheel No. 2 will hug the inside rail for some time until the truck is level enough to relieve the uneven loading. This explains why the rails at the end of the curve, where double tracks are used, are worn for some considerable distance. The rear truck under flexible car is under the same condition as when the car was passing around the curve and great danger exists because of the trucks becoming gripped by listing inward and pressing wheel No. 5 heavily against the rail without having a very vertical load on it. With a rigid car, however, these conditions are very much improved.

You will find tabulated below a table which shows the conditions to which each wheel of the truck is subjected to under the different situations as above outlined. Under normal conditions there would be no pressure between the wheel flanges and the rail. Under other conditions it would vary in intensity, as noted above, and the letters A, B and C are used to denote this pressure, A representing the smallest, of course, and denoting the least resistance.

In the same way the load on the different wheels is designated as D, E, F and G, and the danger of the wheel climbing by H, J, K and L.

As may be seen there are six places where great danger exists of the wheel climbing the rail, and in fact where there is practically nothing to prevent it from so doing. There are also twelve instances where the wheel may climb the rail if it is complicated by other imperfections in the truck or track construction, and it is, therefore, quite evident that the side bearings should be maintained with the proper clearance as specified in our instructions and to be in as good a physical condition as possible to minimize these tendencies.

Sub-para. (III)

WRONG LOADING

The A. R. A. loading rules are based upon scientific study, and when ignored sometimes result in cars leaving the tracks. The necessity for advising agents and shippers of these rules, and inspectors keeping a sharp lookout for incorrect loading, is brought home when one reviews the cost involved by a wreck caused by wrong loading.

Sub-para. (IV)

OTHER CAUSES

Causes of wrecks other than those mentioned are almost unlimited. The failure of any one of many parts of the equipment, a broken or spread rail, ice, snow, or loose stone on track, slid flat wheels, brake beams down, broken springs, etc., are all conditions which may cause wrecks. Improper or carelessly applied linings to journal brasses may possibly be the cause of a derailment as fully explained in M. E. Circular 1055. Inspection as outlined in Section 1 of this book is the means of guarding against these various causes of wrecks, but a sharp lookout along tracks and at trains should be kept by employees at all times to detect any possible cause for derailment or accidents, and once observed effective steps taken to immediately remove the danger.

Para. 3

WRECKING CREWS

Sub-para. (I)

CONSIST

The wrecking crew will in all cases be in charge of a monthly rated foreman, and the members of the crew should be men amenable to discipline as discipline is an important factor in connection with the picking up of wrecks. The wrecking foreman will report directly to the general car foreman on whose division the equipment is regularly stationed. It is our policy to have the wrecking foreman in supreme charge of the outfit, and this is done knowing full well that there is a well-defined difference of opinion as to the advisability of clearing wrecks under the supervision of men especially interested in the salvage of rolling stock, for the reason that the vital thing on a busy line is to get the railroad open again.

In order to always have a proper force ready, the wrecking foreman, engineer, and crew should be employed in the shops on repair tracks in such a way that they may be called at short notice. If the crew is called other than during working hours, they should be readily available by telephone or other means, and forty minutes is the absolute maximum time allowed for a crew to get away when called to a wreck.

Sub-para. (II)**MEALS FOR THE CREW**

Where wrecking outfits are equipped with dining cars, the wrecking foreman is to be considered the purser and out of his own pocket, he shall purchase the supplies needed. The wrecking crew will eat their meals from these provisions and on the first and fifteenth of each month the total cost will be pro-rated and divided so that each individual man pays the cost price for the number of meals he consumed. Having paid his allotment, each wrecker will place an expense account, Form 132-A and 1006, with the company for the amount which he needs for reimbursement, this being only signed and approved by the wrecking foreman, car foreman and general foreman. This cost when pro-rated will generally amount to 40 cents or 50 cents per meal, this being the amount generally placed on the individual expense accounts for remuneration from the company. This is also the amount which wrecking foremen will charge all, including officers, trainmen, sectionmen and others eating in their diners.

Where hand derricks are employed and not equipped with diners, or at stations which are more or less isolated, and we keep men on hand practically for the sole purpose of doing road work and they are called out to a wreck or derailment, the following should be observed. If men usually carry their mid-day luncheon with them and they are only away in connection with the wreck or derailment during one meal hour which would be the regular luncheon, it is not expected that they will ask for the meal to be paid for at a restaurant or otherwise, as to take a meal in this way would generally mean traveling unduly. However, where men go out who are not regularly assigned to road work or men who do not carry their lunch, it will be satisfactory to grant them permission to include the cost of meals in their expense account.

Para. 4**WRECKING OUTFITS****Sub-para. (I)****CONSIST AND LOCATION**

Wrecking trains with steam derricks are held at all of the important terminals and divisional points. Hand derricks are provided for less important stations to protect branch lines where the track and bridges are of light construction.

Tool cars will be equipped in accordance with the requirements for the location they are to be used in. However, all outfits should be provided with a good supply of different sizes of pine and oak blocking from 1" plank to 2", 3" up to 6" thickness, and from 34" to 36" long, and with plenty of good wooden wedges of various sizes. Four to six 50-ton jacks should be kept in the car. Four $3\frac{1}{4}$ " x 18' chains with a grab hook at each end and a ring in the center should be kept in the tool car. Also two large and two small grab hooks to be used to turn over car frames and car bodies. The number and sizes of chains, cables, slings and chokers to be kept on hand will be left to the discretion of the wrecking foreman, there being a difference of opinion as to requirements, and each foreman will provide sufficient to meet his method of work. However, there should be a few chains $1\frac{1}{4}$ " in diameter and 20' long for heavy lifts, and also some

2" in diameter, and there should be four ropes 1" to 3" in diameter, and from 200' to 300' long with proper sized snatch blocks. There will also need to be two guy anchors, four wrecking frogs, and a good supply of tools such as chisels, hammers, and wrenches, and a set of track tools such as claw bars, lining bars, spike mauls, track wrenches, track chisels, shovels, picks with handles, and bags to handle and transfer grain.

The car with track material should be supplied with about 20 rails, complete with fastenings of the pattern used on the main line, one switch complete, one right hand and one left hand spring frog of same angle as used on mainline, two guard rails, 100 to 150 ties, four or five kegs of spikes and a couple of kegs of bolts.

Wrecking trucks must all be marked in white lead with the name of the station to which the wrecker belongs so that when placed under cars no difficulty may be experienced in locating the original trucks when the car reaches repair track.

Drawing 12219-1 shows suggested design of special tools for steam derricks and every wrecking foreman should be in possession of a copy of this drawing which may be obtained upon application, and if any of the tools shown thereon are required, request for same should be made in ordinary way.

Sub-para. (II)

METHOD OF UPKEEP

The wrecker should be stored on a convenient track free from cars or other obstructions so that it may get away quickly at any time.

The boiler should be full of water and coal box full of coal. If outfit is supplied with a bunk car this must be fully equipped with the necessary bedding and blankets for the accomodation of the crew. If a dining car is carried it should be equipped with the proper sized range and suitable table to take care of not less than 18 men at a meal and supplies should be kept at all times for at least a three day period for the crew. It should be seen that the dining car is at all times equipped with suitable dishes and necessary skillets for the range. The car should also carry a field telephone with not less than 150 feet of suitable wire and it should be known that this instrument is at all times in good working order.

Outfits should be kept well painted with all journals properly attended to and everything in proper order. The tools in the tool car should be stored in such a way that it is unnecessary to unload the entire car with tools, jacks, chains, etc., in order to obtain something which is at the bottom. The appearance and upkeep of a wrecking outfit should be the pride of a wrecking foreman.

Para. 5

CALL TO A WRECK

As mentioned previously the crews allotted to a wrecking outfit should be quickly available and within reasonable distance from the point where the outfit is located, and should be reached by telephone or call boy. The chief dispatcher should call the wrecking foreman and give him the full line-up of what the wreck or derailment is, and the wrecking foreman

should make a point of ascertaining as nearly as possible the number of cars involved and their condition and whether it is necessary to take with his outfit gondolas or flat cars to be used at the wreck to place damaged cars and wreckage on. The wrecking foreman will then get in touch with his crew and the maximum time allowed in which to get away is forty minutes, but other than under unusual circumstances, 30 minutes should not be exceeded.

The wrecking outfit is to be made up as follows: The crane directly behind the road engine with the boom trailing, overhanging the truck car. The next car is to be the tool car, and the diner or sleeper will form the rear of the train when road engine is coupled and ready to proceed to the wreck. The outfit will proceed according to laid down instructions by the superintendent of the division as to speed on different stretches of track, *but in no case must a wrecker proceed at a greater speed than 25 miles an hour.* When the wrecking foreman is being advised of the wreck by the dispatcher he should mention the rate of speed at which the outfit will proceed to the wreck so that there may be no possibility of any misunderstanding on this matter, which is very vital. Also while in touch with the dispatcher the wrecking foreman will advise him, should the necessary gondolas and flat cars not be available to pick up and take with him, in order that they may be picked up at the first point where available, or else arrangements made to have them specially sent to the scene of the wreck.

Para. 6

ARRIVAL AT WRECK

As the wrecking outfit nears the scene of the derailment or wreck, the wrecking foreman will ascertain which is the nearest siding to the wreck at which he can arrange for the train crew to cut off the locomotive from the head end and couple on at the rear in order to shove the crane up to the scene of the derailment, if such procedure is necessary. When the machine is shoved up to the nearest point of the derailment that it can reach with safety it will be the duty of the wrecking foreman to quickly look the situation over in company with a member of the crew who is proficient in taking records. They will quickly go over the wreckage, list up the number of cars and get the proper information so that he can by this time connect up his telephone and advise the dispatcher the length of time it will take to open up the main line and length of time it will take to pick up the cars in the derailment. The wrecking foreman will usually have a first-class man who is competent to take his place and proceed to unload the necessary cables, frogs, tools, etc., to rerail cars or set them off so the track can be repaired and put in condition while he, himself is looking over the wreck. The wreck looked over, and the tools unloaded, everything is then in readiness to commence work.

Para. 7

PICKING UP WRECK

The first consideration in picking up a wreck is to take care of injured passengers or crew. In the case of a serious accident to a passenger train medical assistance should be called from the nearest villages or cities and

every possible effort made to get physicians to the wreck as quickly as possible. The wrecking outfit will carry two stretchers and blankets for the removal of injured persons to a place of safety.

In case of serious accident where a large amount of freight has been damaged or stock killed or injured, the claim department must be advised so that they can have one of their agents at the wreck.

The wrecking foreman is to be the sole judge as to whether or not he should tip over a loaded car or elect to pick the car up, if it be in a cut or in a fill, to take it back and set in a location where car and contents will not be further damaged. If derailment is close to passing tracks from the end that the wrecker is working on, and cars can be rerailed and hauled back to this passing track and set out either singly, doubly, or in triple, it should be done. This means if they can be rerailed and hauled on their own trucks. The wrecking foreman must use judgment in accordance with the traffic to be regulated along the line on which the wreck has occurred. If it be a track little used he will endeavor to pick up or rerail all cars possible, but if it be a line that numerous trains are moving on, and congestion will result from the line being blocked, it will be his duty to tip over cars, but he will use judgment in this respect and will be especially careful in the tipping over of foreign cars. It must be borne in mind that operating officials will be mainly interested in getting the line open, but the wrecking foreman must know his business and discriminate between the factor of line blocked, and damage to equipment. Once the line is open, the wrecking foreman will confer with the dispatcher, calling his attention to the conditions, stating what has been done and what is left to be done. If there are numerous trains to be moved, and it is important that they go forward, the wrecker should pull into a passing track until such time as the line is available for his purpose.

When picking up the wreck and while the train is in operation, only tools actually required should be taken out of the tool car, and as soon as the line is clear all tools must be picked up and loaded back into the car for emergency service as there is always the liability of being called to another wreck, before the one they are working on is finally cleared up.

While working, picking up and setting aside cars, the derrick should at all times have sufficient outrigger set to protect the machine when lifting a swinging load. This means outriggers ought to be used on both sides to stay the machine and care for the recoil in case of cables slipping or breaking loose from load.

On a 60 ton derrick, a plate will be found with the following information on it:

10 tons at 20 feet
 15 tons at 16 feet
 50 tons at 16 feet
 60 tons at 16 feet with outrigger.

On a 100 ton derrick, the information will be:

- 15 tons—single line
- 30 tons—with block
- 80 tons at 20 feet, with auxiliary lines
- 100 tons at 17 feet, with auxiliary lines.

In calculating a lift, allowance must be made for any obstructions or entanglements, such as bent truss rods, etc., or any connection with other cars, which will materially add to the dead weight of the lift. It will be considered an act of wilful neglect on the part of the wrecking foreman if outriggers are not properly set out, and wedged so as not only to take the strain during lifting, but hold the wrecker in position in the event of recoil.

Para.8 CLEARING UP AFTER A WRECK

Equipment damaged or destroyed must not be burned on account of the abuse resulting from this privilege. Everything must be picked up and the scene of the wreck or derailment thoroughly cleaned up as nothing looks more unsightly than any destroyed parts of equipment lying along our right of way.

As soon as the clearing away is completed all tools must be properly taken care of and stored in the outfit cars. Wrecked cars, either loaded on other cars or on their own trucks or wrecking trucks, should be so loaded or arranged as to reach repair point safely. Derailed trucks picked up but not replaced under cars must be stenciled with the car number. In addition the car will be marked as having wrecking trucks under it, and the car foreman at the repair point to which cars are proceeding as well as the chief dispatcher, will be so notified, stating whether the wrecking truck is applied to car so that it can be replaced with standard truck at the first point, or whether the car may proceed to destination without delaying load. Whenever possible the car foreman will replace the wrecking truck with a standard truck unless too great a delay to the car will occur. In connection with the application of a wrecking truck to a car it should be noted that it is permissible to haul such a car with the brake beams missing from the wrecking truck so long as the other truck is equipped with brake beams and connected up with hand brakes. However, such a car should not be hauled beyond a repair point. Cars with wrecking trucks applied will not be allowed through interchange. Cars with minor repairs such as bent grabs, etc., will as far as possible be hauled to a repair point by the wrecker to save unnecessary handling, but this will be entirely within the judgment of the wrecking foreman.

After the wreck is cleared up and the outfit is returning, it must be clearly understood that at the first point where coal and water is available the outfit must take its full complement so that it will be in condition on its arrival home, or even when enroute to proceed to another derailment or accident. Immediately on arrival home the wrecker will be thoroughly inspected and any defects found corrected, and all necessary steps taken to put it in first-class shape, ready for immediate use again.

The necessary records in connection with wrecking are fully described in Section 15. Apart from reports, however, it is advisable for every wrecking outfit to keep a log book of about 300 pages. When a call is received to go to a wreck this will be entered in the book together with the date, the hour called, the time men get on the train, time train departed, and time arrived at scene of wreck. Also enter all the information as to the cars involved in the wreck the same as is made out on the regular wreck report. In the handling of this log book there will be a good many things come up that can be advantageously written down so that if further explanations are required at any time in regard to any happenings during the trip the information can be supplied. Any interference by operating officials, messages received enroute or at the wreck should be noted, and also it would be advisable to show the names of the crew and the number of meals partaken on the trip, and all little details in and around the wreck.

Section VIII

GENERAL INFORMATION

Para. 1

FATIGUE OF METALS

You have probably heard of the term or of the theory as to the fatigue of metals in the case of failure of parts in service, and in order that a proper understanding is obtained of this term of reference, the matter is discussed herein in a general way.

The gradual approach of fatigue in metals can be typified by the behavior of a piece of cloth which was made to undergo a strain, and was subsequently released, and again and again stressed, with an interval between each recurrence. When a tensile load is applied to this material, it is certain that before all of the longitudinal yarns can take up the stress, a phase of mutual adjustment of the yarns and their component fibres must take place. Some will be slack, while others will be taut; some will be in close adherence to their neighbors, while others will have comparatively independence of action in the initial unstressed condition. When the load is applied the slack fibres and yarns take up a portion of the load, after the first stretching of those that are taut, while those which adhere to adjacent ones will slip relatively to their neighbors.

If, before the last named state is reached, the load is removed, the specimen will return to a condition of zero, as some of the displacements which have taken place during the earlier states of stress application are not reversible, being maintained at more or less definite values of the friction which exists between the continuous elements. If a second cycle of loading takes place, many of these adjustments will not recur, since the fibres have been permanently disposed into positions more favorable to uniform distribution of the stress. A fairly definite proportion of them, however, will recur, comprising mainly those which, due to insufficiency of friction between elements, have been allowed to appropriate their initial condition of slackness or mutual contact. Thus at every repetition of the loading and unloading cycle certain slips and shifts will take place in the fabric, decreasing, however, in number and extent with each succeeding repetition.

It is this condition which must largely account for the ultimate failure of the fabric under repeated loadings since the energy involved in these slips and shifts of the fibres and yarns is largely expended in mechanical wear of the material itself, diminishing the effective and interlocking which exist between the component yarns of the fabric.

It appears from this that it is almost impossible to apply a strain so that all the fibres will be uniformly taxed at once and all from the start, but that some limited number will take the initial strain, and stretch, others quickly following, will slip on adjacent fibres and finally a sufficient number of them will be able to take the full load, and when unloaded will

be able to go partially back to, or go back nearly to their former positions. In all this there is a slight, perhaps imperceptible deformation which never wholly disappears.

The effect of the load produces a slight ineffacable stretch in the fibres which first feel the load, and the slipping, one may even say, disentangling, of the second lot of fibres, is a form of work which the applied load performs and this "work" process is kept up long enough, ultimate failure is brought about, like the slow filing away of substances when even the lubricated surfaces of cross-head and guides rub upon each other for a long period of time, and this produces the "loose guides," with which we are all so familiar.

In explanation of this condition, and perhaps without any very well defined reason, we often set a time limit to the endurance of car axles and do not take account of the mileage made per car. It is assumed, perhaps rightly, that the average time of service is practically accurate enough to be applied to all equipment, and we are in reality allowing for this very form of loading and unloading of the axle, which is slowly, yet imperceptibly disintegrating the internal structure of the metal. Good quality of material seems to be, from what we have been considering, nothing more than the ability of a piece of metal to put quite a large number of fibres into the field, to take up the initial strain and to lock other fibres together so that they will not readily slip or disentangle. By so doing, this good quality metal, longer withstands the disintegrating and fibre-wearing "work" of the intermittently applied outside strain.

Metal stands to fail from the moment it is put in service and to give up its use despite appearances seems to be the course dictated by reason. The failure of metal, by what is called fatigue, if we mean anything, is the culmination of a long drawn out process and does not come to us like the bolt out of the blue.

We should consider this matter in the analysis of wrecks and failure of parts, also in the reclamation of material.

Para. 2 SHEARING STRENGTH

Sub-para. (I) COMPARISON BETWEEN WOODS AND METALS

Sometimes force may act in such a manner that the material is sheared off. For instance, the rivets in a steam boiler are exposed to shearing stress when the boiler is under steam pressure.

When holes are punched or bars of iron are cut off under punching presses, the action of the punch in cutting off the material is shearing, and the resistance which the material offers is its ultimate shearing strength. The average ultimate shearing strength of wrought iron is 40,000 pounds per square inch. In cast-iron the ultimate shearing strength is usually between 20,000 and 30,000 pounds per square inch. In steel the ultimate shearing strength will vary from 40,000 to 80,000 pounds per square inch.

The resistance offered to shearing is in proportion to the sheared area. Thus, it will take twice as much force to punch a hole two inches in diameter through a three-eighths inch plate as it would to punch a hole

only one inch in diameter through the same plate, and it will take four times as much force to shear off a one-inch bolt as it would to shear off a one-half inch bolt, because the area of a one-inch bolt is four times as large as the area of a one-half inch bolt.

The following table gives the comparative shearing strength of metal and wood:

Material	Pounds per Square Inch
Steel	45,000 to 75,000
Wrought Iron Rivets	35,000 to 55,000
Cast-iron	20,000 to 30,000
Oak, crosswise	4,500 to 5,500
Oak, lengthwise	400 to 700
Pitch Pine, crosswise	4,000 to 5,000
Pitch Pine, lengthwise	400 to 600
Spruce, crosswise	3,000 to 4,000
Spruce, lengthwise	300 to 500

Sub-para. (II) SHEARING STRENGTH OF BOLTS OR RIVETS

The shearing strength of a bolt or rivet can be readily worked out by reference to the following table which shows the area of bolts at the bolt proper and at the root of the thread. On the basis of 35,000 pounds to the square inch the shearing strength of any bolt can be figured out if necessary.

Diam.	No. of threads per-inch	Diam. at-root of thread	Diam. of tap drill	Area in sq. inches of bolt	At root of thread
$\frac{1}{4}$	20	0.185	$\frac{13}{64}$	0.049	0.026
$\frac{5}{16}$	18	0.240	$\frac{1}{4}$	0.076	0.045
$\frac{3}{8}$	16	0.294	$\frac{5}{16}$	0.110	0.068
$\frac{7}{16}$	14	0.345	$\frac{23}{64}$	0.150	0.093
$\frac{1}{2}$	13	0.400	$\frac{27}{64}$	0.196	0.126
$\frac{9}{16}$	12	0.454	$\frac{15}{32}$	0.248	0.162
$\frac{5}{8}$	11	0.507	$\frac{17}{32}$	0.307	0.202
$\frac{3}{4}$	10	0.620	$\frac{41}{64}$	0.442	0.302
$\frac{7}{8}$	9	0.731	$\frac{3}{4}$	0.601	0.419
1	7	0.939	$\frac{31}{32}$	0.994	0.694
$1\frac{1}{8}$	8	0.838	$\frac{55}{64}$	0.785	0.551
$1\frac{1}{4}$	7	1.064	$1\frac{3}{32}$	1.227	0.893
$1\frac{3}{8}$	6	1.158	$1\frac{7}{32}$	1.485	1.057
$1\frac{1}{2}$	6	1.283	$1\frac{11}{32}$	1.767	1.295
$1\frac{5}{8}$	$5\frac{1}{2}$	1.389	$1\frac{27}{32}$	2.074	1.515
$1\frac{3}{4}$	5	1.490	$1\frac{17}{32}$	2.405	1.746
$1\frac{7}{8}$	5	1.615	$1\frac{31}{32}$	2.761	2.051
2	$4\frac{1}{2}$	1.711	$1\frac{49}{64}$	3.142	2.302
$2\frac{1}{4}$	$4\frac{1}{2}$	1.961	$2\frac{1}{64}$	3.976	3.023
$2\frac{1}{2}$	4	2.175	$2\frac{15}{64}$	4.909	3.719
$2\frac{3}{4}$	4	2.425	$2\frac{31}{64}$	5.940	4.620
3	$3\frac{1}{2}$	2.629	$2\frac{11}{16}$	7.069	5.428
$3\frac{1}{4}$	$3\frac{1}{2}$	2.879	$2\frac{15}{16}$	8.296	6.510
$3\frac{1}{2}$	$3\frac{1}{4}$	3.100	$3\frac{11}{64}$	9.621	7.548
$3\frac{3}{4}$	3	3.317	$3\frac{3}{8}$	11.045	8.641
4	3	3.567	$3\frac{5}{8}$	12.566	9.963
$4\frac{1}{4}$	$2\frac{7}{8}$	3.798	$3\frac{27}{32}$	14.186	11.340
$4\frac{1}{2}$	$2\frac{3}{4}$	4.028	$4\frac{3}{32}$	15.904	12.750
$4\frac{3}{4}$	$2\frac{5}{8}$	4.255	$4\frac{5}{16}$	17.721	14.215
5	$2\frac{1}{2}$	4.480	$4\frac{9}{16}$	19.635	15.760
$5\frac{1}{4}$	$2\frac{1}{2}$	4.730	$4\frac{13}{16}$	21.648	17.570
$5\frac{1}{2}$	$2\frac{3}{8}$	4.953	$5\frac{1}{32}$	23.759	19.260
$5\frac{3}{4}$	$2\frac{3}{8}$	5.203	$5\frac{9}{32}$	25.967	21.250
6	$2\frac{1}{4}$	5.423	$5\frac{1}{2}$	28.274	23.090

Para. 3**BREAKING STRAINS****Sub-para. (I)****BOLTS AND RIVETS**

A bolt or rivet will normally require a greater strain as imposed by a straight pull to break it than would be required by a shearing strain. The breaking strain of any bolt is problematical, as the quality of the metal used will have considerable bearing on its ability to resist strains. The following table is a good guide for ordinary wrought iron bolts:

Diam.	No. of threads per inch	Diam. of root of thread	Area of root of thread	Probable breaking load
$\frac{1}{2}$	13	0.400	0.126	6,400 lbs.
$\frac{3}{8}$	12	0.454	0.162	8,200 lbs.
$\frac{5}{8}$	11	0.507	0.202	10,200 lbs.
$\frac{3}{4}$	10	0.620	0.302	15,200 lbs.
$\frac{7}{8}$	9	0.731	0.420	21,100 lbs.
1	8	0.837	0.550	27,500 lbs.
$1\frac{1}{8}$	7	0.940	0.694	34,500 lbs.
$1\frac{1}{4}$	7	1.065	0.893	44,000 lbs.
$1\frac{3}{8}$	6	1.160	1.057	52,000 lbs.
$1\frac{1}{2}$	6	1.284	1,295	63,000 lbs.
$1\frac{5}{8}$	$5\frac{1}{2}$	1.389	1.515	74,000 lbs.
$1\frac{3}{4}$	5	1.491	1.746	84,000 lbs.
$1\frac{7}{8}$	5	1.616	2.051	99,000 lbs.
2	$4\frac{1}{2}$	1.712	2.302	110,000 lbs.
$2\frac{1}{4}$	$4\frac{1}{2}$	1.962	3.023	143,000 lbs.
$2\frac{1}{2}$	4	2.176	3.719	174,000 lbs.
$2\frac{3}{4}$	4	2.426	4.620	214,000 lbs.
3	$3\frac{1}{2}$	2.629	5.428	248,000 lbs.
$3\frac{1}{2}$	$3\frac{1}{4}$	3.100	7.548	337,000 lbs.
4	3	3.567	9.993	435,000 lbs.

Sub-para. (II)**LUMBER**

There are so many ways in which lumber may be tested for breaking strains that it is impossible to express them excepting by a very long explanation and many sets of figures. The following table showing the unit stresses for structural timber in pounds per square inch as issued by the American Railway Engineers Association will be found a useful table for ready reference:

Kind of Timber	Bending			Shearing				Compression			
	Extreme Fiber		Modulus of elas- ticity	Parallel to grain		Longitudi- nal shears in beam		Perpendic- ular to grain		Parallel to grain	
	Aver- age Ulti- mate	Safe Stress		Aver- age Ulti- mate	Safe Stress	Aver- age Ulti- mate	Safe Stress	Elas- tic Lim- it	Safe Stress	Aver- age Ulti- mate	Safe Stress
Douglas Fir...	6100	1200	1510000	690	170	270	110	630	310	3600	1200
Longleaf pine.	6500	1300	1610000	720	180	200	120	520	260	3800	1300
Shortleaf pine.	5600	1100	1480000	710	170	330	130	340	170	3400	1100
White pine....	4400	900	1130000	400	100	180	70	290	150	3000	1000
Spruce.....	4800	1000	1310000	600	150	170	70	370	180	3200	1100
Norway pine..	4200	800	1190000	590	130	250	100	...	150	2600	800
Tamarack....	4600	900	1220000	570	170	260	100	...	220	3200	1000
West. Hemlock	5800	1100	1480000	630	160	270	100	440	220	3500	1200
Redwood.....	5000	900	800000	300	80	...	...	400	150	3300	900
Bald Cypress..	4800	900	1150000	500	120	...	...	340	170	3900	1100
Red Cedar....	4200	800	860000	...	...	...	...	470	230	2800	900
White Oak....	5700	1100	1150000	840	210	270	110	920	450	3500	1300

Para. 4 CLASS OF WHEELS TO BE PLACED UNDER CARS

The general practice on our road is to use cast iron wheels under freight cars and passenger cars up to 100,000 pounds, light weight, and rolled steel or cast steel wheels under heavier equipment. There are exceptions to this rule, and where a freight car is stencilled as being equipped with steel tired, cast steel or rolled steel wheels, if found with cast iron wheels, it must be changed to proper standard. At junction points great care must be shown by inspectors to see that cars coming to us from connections have correct wheels under them, and where found incorrect proper record and billing made.

Under no consideration will a mixture of cast iron and steel wheels be permitted under a car. We must be consistent, maintaining either all cast iron, or all steel wheels under the same car.

So that all concerned may be perfectly clear as to what class of wheels will be placed under passenger train cars, the standard for each car is set out herein. *The exception to the rule, however, is that cars in trans-continental trains, or mountain service (other than branch line service) must have rolled or cast steel wheels.* If, therefore, a car of low enough light weight to use cast iron wheels in ordinary service, and shown accordingly in the list below, were transferred to mountain service or a trans-continental train, *it would immediately require steel wheels.* On the other hand, cars marked as requiring steel wheels may, if confined to limited areas (branch line service, etc.) be permitted to operate with cast iron wheels, but in all such cases the local car forces should take the matter up by correspondence to avoid responsibility in event of the car going into main line service.

It is forbidden to permit any car equipped with cast iron wheels to operate in the following trains, and inspectors have local instructions to refuse to allow such cars to go forward:

Trains 15, 16, 17, 18	Chicago and Seattle
Trains 19, 20	Chicago and San Francisco
Trains 1, 4, 5, 6, 57, 58, 101, X16, 55	Chicago and Minneapolis
Trains 25, 26	Chicago and Kansas City
Trains 7, 8	Chicago and Omaha
Trains 11, 6	Chicago and Sioux City
Trains 51, 52	Chicago and Boulder Jct.

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Exp. Refg. (Steel Underframe)	1	69,700	4	Steel
	2	69,700	4	Steel
	3	69,700	4	Steel
	4	69,700	4	Steel
	5	70,800	4	Steel
	6	69,700	4	Steel
	7	69,200	4	Steel
	8	70,000	4	Steel
	9	71,000	4	Steel
	10	69,700	4	Steel
	11	68,100	4	Steel
	12	69,700	4	Steel
	13	69,700	4	Steel

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	14	71,800	4	Steel
	15	69,700	4	Steel
	16	70,100	4	Steel
	17	69,700	4	Steel
	18	69,900	4	Steel
	19	69,800	4	Steel
	20	70,500	4	Steel
	21	70,100	4	Steel
	22	70,100	4	Steel
	23	70,100	4	Steel
	24	70,200	4	Steel
	25	71,200	4	Steel
	26	70,000	4	Steel
	27	68,900	4	Steel
	28	70,100	4	Steel
	29	70,000	4	Steel
	30	69,800	4	Steel
	31	71,500	4	Steel
	32	71,500	4	Steel
	33	71,500	4	Steel
	34	71,500	4	Steel
	35	71,500	4	Steel
	36	71,500	4	Steel
	37	71,500	4	Steel
	38	71,500	4	Steel
	39	70,700	4	Steel
	40	71,800	4	Steel
	41	73,200	4	Steel
	42	71,500	4	Steel
	43	71,500	4	Steel
	44	71,500	4	Steel
	45	71,500	4	Steel
	46	71,500	4	Steel
	47	71,500	4	Steel
	48	70,500	4	Steel
	49	71,500	4	Steel
	50	71,500	4	Steel
Milk Car (Wood)	100	50,900	4	Cast Iron
	101	52,400	4	Cast Iron
	102	53,100	4	Cast Iron
	103	52,400	4	Cast Iron
	104	52,700	4	Cast Iron
Milk Express (Wood)	300	46,900	4	Cast Iron
	301	44,500	4	Cast Iron
	302	42,000	4	Cast Iron
	303	45,900	4	Cast Iron
	304	47,600	4	Cast Iron
	305	46,700	4	Cast Iron
	306	60,200	6	Cast Iron
	307	56,400	6	Cast Iron
	308	61,700	6	Cast Iron
	309	40,500	4	Cast Iron
	310	52,800	4	Cast Iron
	311	46,300	4	Cast Iron
	312	48,100	4	Cast Iron
	313	53,400	4	Cast Iron
	314	50,600	4	Cast Iron
	315	50,100	4	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	316	50,500	4	Cast Iron
	317	52,800	4	Cast Iron
	318	62,300	6	Cast Iron
	319	61,100	6	Cast Iron
	320	62,200	6	Cast Iron
	321	51,000	4	Cast Iron
	322	64,200	4	Cast Iron
	323	50,700	4	Cast Iron
	324	51,000	4	Cast Iron
	325	51,000	4	Cast Iron
	326	50,500	4	Cast Iron
	327	54,300	4	Cast Iron
	328	50,600	4	Cast Iron
	329	54,400	4	Cast Iron
	330	50,000	4	Cast Iron
	331	58,100	4	Cast Iron
	334	85,200	6	Cast Iron
	335	84,900	6	Cast Iron
	336	86,100	4	Cast Iron
	337	79,500	4	Cast Iron
	338	79,200	6	Cast Iron
	339	85,000	6	Cast Iron
	340	81,000	6	Cast Iron
	341	46,000	4	Cast Iron
	342	55,000	4	Cast Iron
	343	71,000	6	Cast Iron
	344	44,700	4	Cast Iron
	345	48,600	4	Cast Iron
	346	46,500	4	Cast Iron
	347	45,500	4	Cast Iron
Baggage (Wood)	400	44,600	4	Cast Iron
	401	43,600	4	Cast Iron
	402	43,000	4	Cast Iron
	404	47,500	4	Cast Iron
	405	44,500	4	Cast Iron
	407	47,900	4	Cast Iron
	409	44,600	4	Cast Iron
	412	49,600	4	Cast Iron
	414	53,300	4	Cast Iron
Baggage (Wood)	415	75,600	4	Cast Iron
	416	53,100	4	Cast Iron
	417	56,800	4	Cast Iron
	418	52,100	4	Cast Iron
	419	48,900	4	Cast Iron
	420	48,900	4	Cast Iron
	423	49,500	4	Cast Iron
	424	49,000	4	Cast Iron
	450	54,600	4	Cast Iron
	451	56,000	4	Cast Iron
	452	52,300	4	Cast Iron
	453	61,000	6	Cast Iron
	455	61,500	6	Cast Iron
	456	59,600	6	Cast Iron
	457	58,800	6	Cast Iron
	458	60,900	6	Cast Iron
	459	47,800	4	Cast Iron
	460	60,000	6	Cast Iron
	461	51,800	4	Cast Iron
	462	63,700	6	Cast Iron
	463	54,100	4	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Baggage (Wood)	464	55,000	4	Cast Iron
	465	52,900	4	Cast Iron
	466	49,400	4	Cast Iron
	467	60,300	6	Cast Iron
	468	62,200	6	Cast Iron
	469	50,600	6	Cast Iron
	470	52,700	4	Cast Iron
	471	55,300	4	Cast Iron
	472	60,200	6	Cast Iron
	473	66,000	6	Cast Iron
	474	60,600	6	Cast Iron
	475	58,800	6	Cast Iron
	476	62,700	6	Cast Iron
	477	60,700	6	Cast Iron
	478	52,200	6	Cast Iron
	479	61,700	6	Cast Iron
	480	58,000	6	Cast Iron
	481	62,400	6	Cast Iron
	482	62,600	6	Cast Iron
	483	60,300	6	Cast Iron
	484	59,000	6	Cast Iron
	485	61,200	6	Cast Iron
	486	64,200	6	Cast Iron
	487	61,000	6	Cast Iron
	488	61,800	6	Cast Iron
	489	62,000	6	Cast Iron
	490	66,400	6	Cast Iron
	491	59,500	4	Cast Iron
	492	59,000	4	Cast Iron
	493	54,600	4	Cast Iron
	494	54,500	4	Cast Iron
	495	49,000	4	Cast Iron
	500	68,800	6	Cast Iron
	501	80,900	6	Cast Iron
	502	75,500	6	Cast Iron
	503	70,400	6	Cast Iron
	504	67,700	6	Cast Iron
	505	67,400	6	Cast Iron
	506	70,000	6	Cast Iron
	507	71,400	6	Cast Iron
	508	74,300	6	Cast Iron
	509	72,500	6	Cast Iron
	510	67,700	6	Cast Iron
	511	69,200	6	Cast Iron
	512	69,100	6	Cast Iron
	513	73,300	6	Cast Iron
	514	72,600	6	Cast Iron
	515	68,300	6	Cast Iron
	516	70,900	6	Cast Iron
	517	72,700	6	Cast Iron
	518	75,900	6	Cast Iron
	519	78,000	6	Cast Iron
	520	78,400	6	Cast Iron
	521	69,800	6	Cast Iron
	522	71,000	6	Cast Iron
	523	77,800	6	Cast Iron
	524	75,000	6	Cast Iron
	525	76,300	6	Cast Iron
	526	78,500	6	Cast Iron
	527	78,300	6	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Baggage (Wood)	528	81,400	6	Cast Iron
	529	78,400	6	Cast Iron
	530	81,000	6	Cast Iron
	531	77,200	6	Cast Iron
	532	77,900	6	Cast Iron
	533	77,400	6	Cast Iron
	534	79,300	6	Cast Iron
	535	78,700	6	Cast Iron
	536	80,700	6	Cast Iron
	537	83,400	6	Cast Iron
	539	76,000	6	Cast Iron
	540	76,600	6	Cast Iron
	541	77,200	6	Cast Iron
	542	79,000	6	Cast Iron
	543	74,800	6	Cast Iron
	544	77,900	6	Cast Iron
	545	72,100	6	Cast Iron
	546	76,200	6	Cast Iron
	547	81,300	6	Cast Iron
	548	79,700	6	Cast Iron
	549	77,300	6	Cast Iron
	550	75,100	6	Cast Iron
	551	84,100	6	Cast Iron
	552	78,000	6	Cast Iron
	553	78,400	6	Cast Iron
	554	76,000	6	Cast Iron
	556	79,300	6	Cast Iron
	557	78,200	6	Cast Iron
	558	72,700	6	Cast Iron
	559	76,300	6	Cast Iron
	560	76,800	6	Cast Iron
	561	81,800	6	Cast Iron
	562	79,700	6	Cast Iron
	563	75,800	6	Cast Iron
	564	72,700	6	Cast Iron
	565	79,600	6	Cast Iron
	566	78,500	6	Cast Iron
	567	80,400	6	Cast Iron
	568	72,700	6	Cast Iron
	569	81,700	6	Cast Iron
	570	75,600	6	Cast Iron
	571	80,200	6	Cast Iron
	572	74,600	6	Cast Iron
	573	78,900	6	Cast Iron
	574	77,800	6	Cast Iron
	575	73,700	6	Cast Iron
	576	82,500	6	Cast Iron
	577	84,000	6	Cast Iron
	578	76,400	6	Cast Iron
	579	87,500	6	Cast Iron
	580	89,100	6	Cast Iron
	581	80,800	6	Cast Iron
	582	73,300	4	Cast Iron
	583	94,600	6	Cast Iron
	584	81,700	6	Cast Iron
	585	53,800	4	Cast Iron
Baggage (Steel Underframe)	700	96,000	6	Steel
	701	77,500	6	Steel
	702	97,600	6	Steel
	703	97,400	6	Steel

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Baggage (Steel Underframe)	704	96,000	6	Steel
	705	107,800	6	Steel
	706	98,000	6	Steel
	707	99,300	6	Steel
	708	98,800	6	Steel
	709	97,900	6	Steel
	710	97,400	6	Steel
	711	96,400	6	Steel
	712	107,700	6	Steel
	713	112,800	6	Steel
	714	110,000	6	Steel
	715	108,700	6	Steel
	716	113,400	6	Steel
	717	113,800	6	Steel
	718	108,500	6	Steel
	719	114,200	6	Steel
	720	104,000	6	Steel
	721	114,400	6	Steel
	722	108,700	6	Steel
	723	103,800	6	Steel
	724	105,000	6	Steel
	725	113,000	6	Steel
	726	102,700	6	Steel
	727	114,100	6	Steel
	728	116,800	6	Steel
	729	115,700	6	Steel
	730	109,600	6	Steel
	731	118,100	6	Steel
	732	109,300	6	Steel
	733	108,900	6	Steel
	734	116,300	6	Steel
	735	117,000	6	Steel
	736	118,100	6	Steel
	737	116,200	6	Steel
	738	88,800	6	Steel
	739	117,900	6	Steel
	740	117,000	6	Steel
	741	116,400	6	Steel
Baggage (Steel)	800	121,500	6	Steel
	801	120,200	6	Steel
	802	117,100	6	Steel
	803	126,900	6	Steel
	1000	135,100	6	Steel
	1001	137,000	6	Steel
	1002	137,900	6	Steel
	1003	132,800	6	Steel
	1004	129,800	6	Steel
	1005	134,000	6	Steel
	1006	135,000	6	Steel
	1007	135,900	6	Steel
	1008	110,200	6	Steel
	1009	133,900	6	Steel
	1010	135,400	6	Steel
	1011	134,600	6	Steel
	1012	133,000	6	Steel
	1013	136,400	6	Steel
	1014	129,000	6	Steel
	1015	134,200	6	Steel
	1016	136,100	6	Steel
	1017	135,000	6	Steel

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	1018	129,200	6	Steel
	1019	129,800	6	Steel
	1020	133,300	6	Steel
	1021	129,000	6	Steel
	1022	129,000	6	Steel
	1023	124,900	6	Steel
	1024	135,100	6	Steel
	1025	124,200	6	Steel
	1026	137,100	6	Steel
	1027	140,900	6	Steel
	1028	137,300	6	Steel
	1029	139,100	6	Steel
	1030	131,300	6	Steel
	1031	137,900	6	Steel
	1032	137,800	6	Steel
	1033	138,800	6	Steel
	1034	128,800	6	Steel
	1035	134,900	6	Steel
	1036	126,300	6	Steel
	1037	126,700	6	Steel
Express (Steel)	1038	126,700	6	Steel
	1039	126,800	6	Steel
	1040	126,700	6	Steel
	1041	134,900	6	Steel
	1042	124,900	6	Steel
	1043	132,900	6	Steel
	1044	124,700	6	Steel
	1045	133,200	6	Steel
	1046	126,700	6	Steel
	1047	125,200	6	Steel
	1048	132,100	6	Steel
	1049	129,100	6	Steel
	1050	130,700	6	Steel
	1051	134,200	6	Steel
	1052	130,800	6	Steel
	1053	136,300	6	Steel
	1054	125,600	6	Steel
	1055	134,900	6	Steel
Mail Apartment (Wood)	1500	50,800		Cast Iron
	1503	43,900	4	Cast Iron
	1506	47,700	4	Cast Iron
	1507	47,100	4	Cast Iron
	1509	47,700	4	Cast Iron
	1510	56,900	4	Cast Iron
	1520	44,500	4	Cast Iron
	1521	61,500	6	Cast Iron
	1525	68,300	6	Cast Iron
	1526	69,300	6	Cast Iron
	1527	48,000	4	Cast Iron
	1528	61,300	6	Cast Iron
	1529	67,900	6	Cast Iron
	1531	61,500	4	Cast Iron
	1532	59,800	6	Cast Iron
	1533	68,900	6	Cast Iron
	1534	70,200	6	Cast Iron
	1535	67,800	6	Cast Iron
	1536	68,300	6	Cast Iron
	1537	70,200	6	Cast Iron
	1538	69,500	6	Cast Iron
	1539	69,400	6	Cast Iron

Name of Car	Kind	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	1540	68,100	6	Cast Iron
	1541	69,500	6	Cast Iron
	1542	67,600	6	Cast Iron
	1543	69,800	6	Cast Iron
	1544	69,700	6	Cast Iron
	1545	68,400	6	Cast Iron
	1546	79,400	4	Cast Iron
	1551	89,900	6	Cast Iron
	1552	81,700	6	Cast Iron
	1553	90,900	6	Cast Iron
	1554	93,300	6	Cast Iron
	1555	89,700	6	Cast Iron
	1556	74,700	6	Cast Iron
	1557	93,900	6	Cast Iron
	1558	94,800	6	Cast Iron
	1559	94,200	6	Cast Iron
	1560	94,600	6	Cast Iron
	1561	99,300	6	Cast Iron
	1562	98,500	6	Cast Iron
	1563	97,700	6	Cast Iron
	1564	94,800	6	Cast Iron
	1565	94,800	6	Cast Iron
Mail Apartment (Wood)	1566	100,200	6	Cast Iron
	1567	100,700	6	Cast Iron
	1568	93,800	6	Cast Iron
	1569	91,700	6	Cast Iron
	1570	93,500	6	Cast Iron
	1571	93,200	6	Cast Iron
	1572	89,400	6	Cast Iron
	1573	92,400	6	Cast Iron
	1574	109,000	6	Cast Iron
	1575	96,100	6	Cast Iron
	1576	100,600	6	Cast Iron
	1577	98,100	6	Cast Iron
	1578	99,000	6	Cast Iron
	1579	98,700	6	Cast Iron
	1580	96,900	6	Cast Iron
Mail Apartment (Steel Underframe)	1600	99,900	6	Cast Iron
	1601	100,500	6	Steel
	1602	102,800	6	Steel
	1603	103,100	6	Steel
	1604	102,800	6	Steel
	1605	84,700	6	Steel
	1607	96,000	6	Steel
	1608	100,400	6	Steel
	1609	100,400	6	Steel
	1610	86,000	6	Steel
	1611	100,700	6	Steel
	1612	100,700	6	Steel
	1613	100,500	6	Steel
	1614	100,100	6	Steel
	1615	99,300	6	Steel
	1616	99,600	6	Steel
	1917	99,500	6	Steel
	1618	100,200	6	Steel
	1619	101,300	6	Steel
	1620	100,600	6	Steel
	1621	77,400	6	Steel
	1622	102,500	6	Steel
	1623	96,000	6	Steel

Name of Car	Kind	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Mail Apartment (Steel Underframe)	1624	100,500	6	Steel
	1625	104,300	6	Steel
	1626	100,600	6	Steel
	1627	103,900	6	Steel
	1628	77,700	6	Steel
	1629	101,300	6	Steel
	1630	103,400	6	Steel
	1631	101,400	6	Steel
	1632	101,600	6	Steel
	1633	96,000	6	Steel
	1634	105,800	6	Steel
	1635	103,800	6	Steel
	1636	115,600	6	Steel
	1637	114,600	6	Steel
	1638	115,600	6	Steel
	1639	116,000	6	Steel
	1640	118,000	6	Steel
	1641	116,300	6	Steel
	1642	115,400	6	Steel
	1643	116,200	6	Steel
	1644	115,900	6	Steel
	1645	115,900	6	Steel
	1606	102,500	6	Steel
Mail Apartment (Steel)	1800	145,700	6	Steel
	1801	146,900	6	Steel
	1802	118,600	6	Steel
	1803	121,300	6	Steel
	1804	121,000	6	Steel
	1805	119,500	6	Steel
	1806	119,400	6	Steel
	1807	123,500	6	Steel
	1808	122,400	6	Steel
	1809	118,000	6	Steel
	1810	118,000	6	Steel
	1811	119,200	6	Steel
	1812	120,200	6	Steel
	1813	115,100	6	Steel
	1814	121,400	6	Steel
	1815	120,000	6	Steel
	1816	118,700	6	Steel
	1817	118,700	6	Steel
	1818	119,700	6	Steel
	1819	120,100	6	Steel
	1820	118,600	6	Steel
	1821	118,200	6	Steel
	1822	120,300	6	Steel
	1823	120,700	6	Steel
	1824	122,300	6	Steel
	1825	120,200	6	Steel
	1826	121,800	6	Steel
	1827	121,500	6	Steel
	1828	121,900	6	Steel
	1829	119,300	6	Steel
	1830	124,400	6	Steel
Mail (Steel Underframe)	2000	112,100	6	Steel
	2004	115,400	6	Steel
	2005	115,700	6	Steel
	2006	114,700	6	Steel
Mail (Steel)	2100	113,600	6	Steel
	2101	121,000	6	Steel

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Mail (Steel)	2102	119,800	6	Steel
	2103	125,300	6	Steel
	2104	114,600	6	Steel
	2105	125,100	6	Steel
	2106	119,800	6	Steel
	2107	125,600	6	Steel
	2108	120,700	6	Steel
	2109	120,600	6	Steel
	2110	112,600	6	Steel
	2111	113,400	6	Steel
	2112	124,200	6	Steel
	2113	111,400	6	Steel
	2114	127,200	6	Steel
	2115	118,700	6	Steel
	2116	118,700	6	Steel
	2117	117,800	6	Steel
	2118	118,600	6	Steel
	2119	124,400	6	Steel
	2120	124,500	6	Steel
	2121	126,000	6	Steel
	2122	126,000	6	Steel
	2123	126,800	6	Steel
	2124	124,300	6	Steel
	2125	125,000	6	Steel
	2126	124,800	6	Steel
	2127	124,800	6	Steel
	2128	119,400	6	Steel
	2129	119,300	6	Steel
	2130	126,100	6	Steel
	2131	125,100	6	Steel
	2132	125,700	6	Steel
	2133	119,400	6	Steel
	2134	127,400	6	Steel
	2135	119,100	6	Steel
P. & B. (Wood)	2500	40,800	4	Cast Iron
	2501	50,500	4	Cast Iron
	2502	42,700	4	Cast Iron
	2503	42,100	4	Cast Iron
	2504	46,800	4	Cast Iron
	2505	43,300	4	Cast Iron
	2506	44,600	4	Cast Iron
	2507	48,500	4	Cast Iron
	2508	42,300		Cast Iron
	2509	48,300	4	Cast Iron
	2510	50,200	4	Cast Iron
	2511	48,000	4	Cast Iron
	2512	45,500	4	Cast Iron
	2514	54,200	4	Cast Iron
	2515	50,000	4	Cast Iron
	2516	47,200	4	Cast Iron
	2517	48,000	4	Cast Iron
	2518	46,000	4	Cast Iron
	2519	48,300	4	Cast Iron
	2520	51,100	4	Cast Iron
	2521	52,900	4	Cast Iron
	2522	50,800	4	Cast Iron
	2523	49,900	4	Cast Iron
	2524	52,700	4	Cast Iron
	2525	50,500	4	Cast Iron
	2526	50,500	4	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
P. & B. (Wood)	2527	50,600	4	Cast Iron
	2528	48,800	4	Cast Iron
	2529	53,200	4	Cast Iron
	2530	50,300	4	Cast Iron
	2531	51,000	4	Cast Iron
	2532	52,300	4	Cast Iron
	2533	54,400	4	Cast Iron
	2534	55,500	4	Cast Iron
	2535	59,300	6	Cast Iron
	2536	61,000	6	Cast Iron
	2537	54,200	4	Cast Iron
	2538	61,400	6	Cast Iron
	2539	54,500	4	Cast Iron
	2540	49,100	4	Cast Iron
	2541	54,600	4	Cast Iron
	2542	55,300	4	Cast Iron
	2543	54,300	4	Cast Iron
	2544	49,400	4	Cast Iron
	2545	49,900	4	Cast Iron
	2546	54,900	4	Cast Iron
	2547	62,000	6	Cast Iron
	2548	44,500	4	Cast Iron
	2549	54,300	4	Cast Iron
	2550	57,500	4	Cast Iron
	2551	57,000	4	Cast Iron
	2552	54,600	4	Cast Iron
	2553	61,000	4	Cast Iron
	2554	55,600	4	Cast Iron
	2555	55,700	4	Cast Iron
	2556	57,300	4	Cast Iron
	2557	50,500	4	Cast Iron
	2558	62,500	6	Cast Iron
	2559	50,800	4	Cast Iron
	2560	53,900	4	Cast Iron
	2561	58,700	6	Cast Iron
	2562	61,400	6	Cast Iron
	2563	54,600	4	Cast Iron
	2564	62,900	6	Cast Iron
	2565	53,300	4	Cast Iron
	2566	57,800	6	Cast Iron
	2567	58,000	6	Cast Iron
	2568	63,600	6	Cast Iron
	2569	54,200	4	Cast Iron
	2570	55,900	4	Cast Iron
	2571	52,900	4	Cast Iron
	2572	58,400	6	Cast Iron
	2573	54,600	4	Cast Iron
	2574	59,200	6	Cast Iron
	2575	60,900	6	Cast Iron
	2576	52,700	4	Cast Iron
	2577	55,500	4	Cast Iron
	2578	53,800	4	Cast Iron
	2579	50,700	4	Cast Iron
	2580	55,200	4	Cast Iron
	2581	56,000	4	Cast Iron
	2582	56,900	4	Cast Iron
	2583	57,700	4	Cast Iron
	2584	54,200	4	Cast Iron
	2585	56,500	4	Cast Iron
	2586	61,900	4	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	2587	48,500	4	Cast Iron
	2589	49,400	4	Cast Iron
	2590	48,000	4	Cast Iron
	2591	58,000	4	Cast Iron
	2592	55,100	4	Cast Iron
	2593	57,000	4	Cast Iron
	2594	61,200	6	Cast Iron
	2596	71,400	6	Cast Iron
P. & B. (Wood)	2597	72,900	6	Cast Iron
	2598	72,900	6	Cast Iron
	2599	60,500	4	Cast Iron
	2800	102,800	6	Cast Iron
	2801	85,700	6	Cast Iron
	2802	86,300	6	Cast Iron
	2803	111,500	6	Cast Iron
	2804	98,700	6	Cast Iron
	2805	96,000	6	Cast Iron
	2806	69,400	6	Cast Iron
	2807	73,800	6	Cast Iron
	2808	92,800	6	Cast Iron
P. & B. (Steel)	2900	134,900	6	Steel
	2901	134,200	6	Steel
Coach (Wood)	3000	54,200	4	Cast Iron
	3003	53,300	4	Cast Iron
	3004	54,000	4	Cast Iron
	3005	56,000	6	Cast Iron
	3008	60,700	6	Cast Iron
	3010	49,500	4	Cast Iron
	3011	46,400	4	Cast Iron
	3013	50,000	4	Cast Iron
	3014	50,000	4	Cast Iron
	3017	52,000	4	Cast Iron
	3019	51,100	4	Cast Iron
	3020	49,800	4	Cast Iron
	3021	51,900	4	Cast Iron
	3023	53,200	4	Cast Iron
	3025	53,200	4	Cast Iron
	3026	53,800	4	Cast Iron
	3027	54,300	4	Cast Iron
	3028	59,600	6	Cast Iron
	3029	52,600	4	Cast Iron
	3030	60,900	6	Cast Iron
	3032	60,900	6	Cast Iron
	3033	60,200	6	Cast Iron
	3034	58,400	6	Cast Iron
	3035	47,800	4	Cast Iron
	3037	61,400	6	Cast Iron
	3038	54,900	6	Cast Iron
	3040	60,700	6	Cast Iron
	3042	57,200	4	Cast Iron
	3045	55,800	4	Cast Iron
	3046	53,600	4	Cast Iron
	3047	52,400	4	Cast Iron
	3048	53,900	4	Cast Iron
	3049	62,000	6	Cast Iron
	3050	50,500	4	Cast Iron
	3051	53,700	4	Cast Iron
	3052	48,900	4	Cast Iron
	3053	55,700	4	Cast Iron
	3054	52,300	4	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	3055	51,100	4	Cast Iron
	3057	51,800	4	Cast Iron
	3058	49,500	4	Cast Iron
	3059	50,200	4	Cast Iron
	3060	52,900	4	Cast Iron
	3061	60,100	6	Cast Iron
	3065	53,400	4	Cast Iron
	3066	56,100	4	Cast Iron
	3067	50,900	6	Cast Iron
	3068	53,900	4	Cast Iron
	3069	50,200	4	Cast Iron
	3070	51,300	4	Cast Iron
	3071	61,300	6	Cast Iron
	3072	53,700	4	Cast Iron
	3073	51,000	4	Cast Iron
	3074	51,700	4	Cast Iron
Coach (Wood)	3075	54,100	4	Cast Iron
	3076	51,700	4	Cast Iron
	3077	54,100	4	Cast Iron
	3078	53,200	4	Cast Iron
	3079	52,300	4	Cast Iron
	3080	55,700	4	Cast Iron
	3082	59,500	6	Cast Iron
	3083	76,400	4	Cast Iron
	3085	51,600	4	Cast Iron
	3086	56,000	4	Cast Iron
	3087	63,200	6	Cast Iron
	3089	55,300	4	Cast Iron
	3090	55,800	4	Cast Iron
	3093	63,300	6	Cast Iron
	3094	55,400	4	Cast Iron
	3095	56,700	4	Cast Iron
	3096	55,200	4	Cast Iron
	3098	57,000	4	Cast Iron
	3099	55,800	4	Cast Iron
	3100	55,800	4	Cast Iron
	3101	56,600	4	Cast Iron
	3102	55,700	4	Cast Iron
	3103	56,000	4	Cast Iron
	3104	55,900	4	Cast Iron
	3105	57,600	4	Cast Iron
	3106	51,400	4	Cast Iron
	3107	55,200	4	Cast Iron
	3108	54,300	4	Cast Iron
	3109	57,200	4	Cast Iron
	3110	55,000	4	Cast Iron
	3111	53,900	4	Cast Iron
	3112	55,800	4	Cast Iron
	3113	56,000	4	Cast Iron
	3114	56,500	4	Cast Iron
	3115	57,100	4	Cast Iron
	3116	54,600	4	Cast Iron
	3117	54,600	4	Cast Iron
	3118	56,000	4	Cast Iron
	3119	55,300	4	Cast Iron
	3120	55,600	4	Cast Iron
	3121	53,500	4	Cast Iron
	3122	55,200	4	Cast Iron
	3123	54,300	4	Cast Iron
	3124	55,000	4	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	3125	57,100	4	Cast Iron
	3126	54,100	4	Cast Iron
	3127	57,500	4	Cast Iron
	3128	55,000	4	Cast Iron
	3129	54,300	4	Cast Iron
	3130	54,900	4	Cast Iron
	3131	57,700	4	Cast Iron
	3132	51,000	4	Cast Iron
	3133	56,300	4	Cast Iron
	3134	56,700	4	Cast Iron
	3135	55,900	4	Cast Iron
	3136	56,700	4	Cast Iron
	3137	56,300	4	Cast Iron
	3138	55,100	4	Cast Iron
Coach (Wood)	3139	53,700	4	Cast Iron
	3140	53,600	4	Cast Iron
	3141	53,700	4	Cast Iron
	3142	53,900	4	Cast Iron
	3143	54,000	4	Cast Iron
	3144	53,800	4	Cast Iron
	3145	59,100	4	Cast Iron
	3146	59,100	4	Cast Iron
	3247	57,800	4	Cast Iron
	3148	59,300	4	Cast Iron
	3149	65,700	4	Cast Iron
	3150	58,200	4	Cast Iron
	3151	58,900	4	Cast Iron
	3152	60,000	4	Cast Iron
	3153	60,300	4	Cast Iron
	3158	55,500	4	Cast Iron
	3159	50,700	4	Cast Iron
	3160	72,000	6	Cast Iron
	3161	62,300	6	Cast Iron
	3173	52,900	4	Cast Iron
	3174	52,200	4	Cast Iron
	3175	49,500	4	Cast Iron
	3176	52,000	4	Cast Iron
	3177	53,000	4	Cast Iron
	3178	51,600	4	Cast Iron
	3179	51,300	4	Cast Iron
	3180	48,800	4	Cast Iron
	3181	52,500	4	Cast Iron
	3183	53,700	4	Cast Iron
	3185	52,800	4	Cast Iron
	3186	53,200	4	Cast Iron
	3187	53,900	4	Cast Iron
	3188	54,500	4	Cast Iron
	3189	54,200	4	Cast Iron
	3191	55,400	4	Cast Iron
	3193	59,600	6	Cast Iron
	3194	54,000	4	Cast Iron
	3195	57,300	4	Cast Iron
	3196	55,300	4	Cast Iron
	3197	59,000	4	Cast Iron
	3198	57,300	4	Cast Iron
	3199	61,400	4	Cast Iron
	3200	60,300	4	Cast Iron
	3201	62,600	4	Cast Iron
	3202	57,200	6	Cast Iron
	3203	62,500	4	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	3204	61,600	6	Cast Iron
	3206	62,900	6	Cast Iron
	3207	63,600	6	Cast Iron
	3210	62,800	6	Cast Iron
	3211	62,200	6	Cast Iron
	3212	61,400	4	Cast Iron
	3213	58,900	4	Cast Iron
	3214	62,800	6	Cast Iron
	3215	63,300	6	Cast Iron
	3216	63,200	4	Cast Iron
	3217	61,300	6	Cast Iron
	3219	63,700	6	Cast Iron
Coach (Wood)	3220	62,400	6	Cast Iron
	3221	57,600	4	Cast Iron
	3222	56,000	4	Cast Iron
	3223	56,700	4	Cast Iron
	3224	56,000	4	Cast Iron
	3225	57,700	4	Cast Iron
	3227	62,500	6	Cast Iron
	3228	63,000	6	Cast Iron
	3229	62,800	6	Cast Iron
	3230	54,700	4	Cast Iron
	3231	55,500	4	Cast Iron
	3232	57,400	4	Cast Iron
	3233	57,400	4	Cast Iron
	3234	61,900	6	Cast Iron
	3235	58,300	4	Cast Iron
	3236	62,900	6	Cast Iron
	3237	62,700	6	Cast Iron
	3238	62,100	6	Cast Iron
	3239	63,700	6	Cast Iron
	3240	64,100	6	Cast Iron
	3241	62,500	6	Cast Iron
	3242	62,800	6	Cast Iron
	3243	62,300	6	Cast Iron
	3244	66,100	6	Cast Iron
	3245	56,700	4	Cast Iron
	3246	64,500	6	Cast Iron
	3247	54,000	6	Cast Iron
	3248	63,800	6	Cast Iron
	3249	63,100	6	Cast Iron
	3250	63,800	6	Cast Iron
	3251	63,700	6	Cast Iron
	3252	64,900	6	Cast Iron
	3253	63,300	6	Cast Iron
	3254	63,900	6	Cast Iron
	3255	63,600	6	Cast Iron
	3256	65,100	6	Cast Iron
	3257	59,000	4	Cast Iron
	3258	63,700	6	Cast Iron
	3259	65,900	6	Cast Iron
	3260	63,700	6	Cast Iron
	3261	64,000	6	Cast Iron
	3262	63,100	6	Cast Iron
	3263	63,000	6	Cast Iron
	3264	63,500	6	Cast Iron
	3265	63,100	6	Cast Iron
	3266	64,700	6	Cast Iron
	3267	63,800	6	Cast Iron
	3268	64,300	6	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	3269	62,300	6	Cast Iron
	3270	57,100	4	Cast Iron
	3271	59,300	4	Cast Iron
	3272	60,500	4	Cast Iron
	3273	61,300	4	Cast Iron
	3274	59,700	4	Cast Iron
	3275	58,900	4	Cast Iron
	3276	57,900	4	Cast Iron
	3277	60,000	4	Cast Iron
	3279	59,600	4	Cast Iron
	3280	55,800	6	Cast Iron
Coach (Wood)	3281	54,200	4	Cast Iron
	3282	57,600	4	Cast Iron
	3283	63,400	4	Cast Iron
	3284	65,100	4	Cast Iron
	3285	66,800	6	Cast Iron
	3286	62,800	6	Cast Iron
	3287	64,800	6	Cast Iron
	3288	64,600	6	Cast Iron
	3289	60,300	4	Cast Iron
	3290	64,000	6	Cast Iron
	3291	64,600	6	Cast Iron
	3292	68,200	6	Cast Iron
	3293	64,400	6	Cast Iron
	3400	67,800	6	Cast Iron
	3401	67,600	6	Cast Iron
	3402	69,200	6	Cast Iron
	3403	65,800	6	Cast Iron
	3404	68,200	6	Cast Iron
	3405	68,000	6	Cast Iron
	3407	60,000	6	Cast Iron
	3408	66,800	6	Cast Iron
	3410	66,500	6	Cast Iron
	3414	62,500	4	Cast Iron
	3415	67,600	6	Cast Iron
	3417	68,100	6	Cast Iron
	3418	68,200	6	Cast Iron
	3420	65,000	6	Cast Iron
	3421	62,500	4	Cast Iron
	3424	69,300	6	Cast Iron
	3425	67,400	6	Cast Iron
	3426	61,500	4	Cast Iron
	3427	68,600	4	Cast Iron
	3428	68,000	4	Cast Iron
	3429	67,500	4	Cast Iron
	3430	68,000	4	Cast Iron
	3431	68,000	6	Cast Iron
	3432	68,200	6	Cast Iron
	3500	69,700	6	Cast Iron
	3501	69,500	6	Cast Iron
	3502	69,500	6	Cast Iron
	3503	70,000	6	Cast Iron
	3504	70,400	6	Cast Iron
	3505	68,800	6	Cast Iron
	3506	69,100	6	Cast Iron
	3507	72,900	6	Cast Iron
	3508	66,200	4	Cast Iron
	3509	64,900	4	Cast Iron
	3510	65,000	4	Cast Iron
	3511	63,600	4	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	3512	65,700	4	Cast Iron
	3513	70,600	6	Cast Iron
	3515	64,000	4	Cast Iron
	3516	65,600	4	Cast Iron
	3517	65,900	4	Cast Iron
	3518	70,100	6	Cast Iron
Coach (Wood)	3519	65,000	4	Cast Iron
	3520	67,300	6	Cast Iron
	3521	65,200	4	Cast Iron
	3522	69,500	6	Cast Iron
	3523	70,100	6	Cast Iron
	3524	64,500	4	Cast Iron
	3525	70,200	6	Cast Iron
	3526	93,500	6	Cast Iron
	3527	92,500	6	Cast Iron
	3528	82,200	6	Cast Iron
	3529	82,000	6	Cast Iron
	3530	84,600	6	Cast Iron
	3531	83,300	6	Cast Iron
	3532	82,300	6	Cast Iron
	3533	68,900	4	Cast Iron
	3534	101,900	6	Cast Iron
	3535	77,700	6	Cast Iron
	3536	78,400	6	Cast Iron
	3537	77,500	6	Cast Iron
	3538	91,500	6	Cast Iron
	3539	76,200	6	Cast Iron
	3540	78,900	6	Cast Iron
	3541	79,800	6	Cast Iron
	3542	79,000	6	Cast Iron
	3543	78,000	6	Cast Iron
	3544	89,300	6	Cast Iron
	3545	88,200	6	Cast Iron
	3546	94,900	6	Cast Iron
	3547	70,700	6	Cast Iron
	3548	70,600	6	Cast Iron
	3600	94,400	6	Cast Iron
	3601	94,600	6	Cast Iron
	3602	98,600	6	Cast Iron
	3603	93,600	6	Cast Iron
	3604	95,200	6	Cast Iron
	3605	93,900	6	Cast Iron
	3606	94,500	6	Cast Iron
	3607	94,800	6	Cast Iron
	3608	95,200	6	Cast Iron
	3609	93,700	6	Cast Iron
	3610	93,100	6	Cast Iron
	3611	94,000	6	Cast Iron
	3612	96,200	6	Cast Iron
	3613	94,100	6	Cast Iron
	3614	94,600	6	Cast Iron
	3615	91,600	6	Cast Iron
	3616	92,700	6	Cast Iron
	3617	94,500	6	Cast Iron
	3618	91,800	6	Cast Iron
	3619	92,900	6	Cast Iron
	3620	93,500	6	Cast Iron
	3621	95,300	6	Cast Iron
	3622	92,800	6	Cast Iron
	3623	93,400	6	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Coach (Wood)	3624	91,100	6	Cast Iron
	3625	93,400	6	Cast Iron
	3626	94,400	6	Cast Iron
	3627	94,500	6	Cast Iron
	3628	93,200	6	Cast Iron
	3629	93,400	6	Cast Iron
	3630	92,000	6	Cast Iron
	3631	91,800	6	Cast Iron
	3632	93,700	6	Cast Iron
	3633	94,000	6	Cast Iron
	3634	94,400	6	Cast Iron
	3635	93,500	6	Cast Iron
	3636	94,400	6	Cast Iron
	3637	95,300	6	Cast Iron
	3639	93,700	6	Cast Iron
	3640	93,500	6	Cast Iron
	3641	93,500	6	Cast Iron
	3642	92,500	6	Cast Iron
	3643	93,200	6	Cast Iron
	3644	93,500	6	Cast Iron
	3645	94,200	6	Cast Iron
	3646	95,000	6	Cast Iron
	3647	93,300	6	Cast Iron
	3648	96,900	6	Cast Iron
	3649	92,800	6	Cast Iron
	3650	94,600	6	Cast Iron
	3651	94,600	6	Cast Iron
	3652	94,500	6	Cast Iron
	3653	92,500	6	Cast Iron
	3654	95,100	6	Cast Iron
	3655	94,300	6	Cast Iron
	3656	94,700	6	Cast Iron
	3657	94,400	6	Cast Iron
	3658	95,700	6	Cast Iron
	3659	119,100	6	Cast Iron
	3660	100,500	6	Cast Iron
	3661	97,900	6	Cast Iron
	3662	98,100	6	Cast Iron
	3663	99,300	6	Cast Iron
	3664	99,700	6	Cast Iron
	3665	99,400	6	Cast Iron
	3666	99,300	6	Cast Iron
	3667	92,000	6	Cast Iron
	3668	99,700	6	Cast Iron
	3669	94,200	6	Cast Iron
	3670	96,000	6	Cast Iron
	3671	93,500	6	Cast Iron
	3672	95,800	6	Cast Iron
	3673	94,800	6	Cast Iron
	3674	96,400	6	Cast Iron
	3675	96,000	6	Cast Iron
	3676	94,700	6	Cast Iron
	3677	94,400	6	Cast Iron
	3678	98,600	6	Cast Iron
	3680	98,300	6	Cast Iron
	3681	97,700	6	Cast Iron
	3682	96,200	6	Cast Iron
Coach (Wood)	3683	97,000	6	Cast Iron
	3684	98,700	6	Cast Iron
	3685	100,300	6	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	3686	96,000	6	Cast Iron
	3687	97,500	6	Cast Iron
	3688	98,500	6	Cast Iron
	3689	98,100	6	Cast Iron
	3690	96,800	6	Cast Iron
	3691	97,800	6	Cast Iron
	3692	97,100	6	Cast Iron
	3693	97,600	6	Cast Iron
	3694	96,000	6	Cast Iron
	3695	97,500	6	Cast Iron
	3696	97,700	6	Cast Iron
	3697	95,800	6	Cast Iron
	3698	98,600	6	Cast Iron
	3699	100,100	6	Cast Iron
	3700	97,000	6	Cast Iron
	3701	97,800	6	Cast Iron
	3702	98,400	6	Cast Iron
	3703	97,100	6	Cast Iron
	3704	99,900	6	Cast Iron
	3705	97,800	6	Cast Iron
	3706	97,700	6	Cast Iron
	3707	96,900	6	Cast Iron
	3708	98,400	6	Cast Iron
	3709	96,900	6	Cast Iron
	3710	98,700	6	Cast Iron
	3711	96,700	6	Cast Iron
	3712	96,900	6	Cast Iron
	3713	97,100	6	Cast Iron
	3714	98,000	6	Cast Iron
	3715	98,000	6	Cast Iron
	3716	96,400	6	Cast Iron
	3717	98,400	6	Cast Iron
	3718	98,100	6	Cast Iron
	3719	97,800	6	Cast Iron
	3720	98,900	6	Cast Iron
	3721	97,300	6	Cast Iron
	3722	99,300	6	Cast Iron
	3723	98,500	6	Cast Iron
	3724	98,400	6	Cast Iron
	3725	100,200	6	Cast Iron
	3726	97,700	6	Cast Iron
	3727	99,900	6	Cast Iron
	3728	96,700	6	Cast Iron
	3729	97,500	6	Cast Iron
	3730	99,100	6	Cast Iron
	3731	98,400	6	Cast Iron
	3732	97,600	6	Cast Iron
	3733	98,300	6	Cast Iron
	3734	98,300	6	Cast Iron
	3735	99,100	6	Cast Iron
	3736	98,500	6	Cast Iron
	3737	96,500	6	Cast Iron
	3738	98,000	6	Cast Iron
	3739	94,600	6	Cast Iron
Coach (Wood)	3740	98,700	6	Cast Iron
	3741	97,700	6	Cast Iron
	3742	99,100	6	Cast Iron
	3743	96,400	6	Cast Iron
	3744	97,600	6	Cast Iron
	3745	97,200	6	Cast Iron

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	3746	98,200	6	Cast Iron
	3747	97,300	6	Cast Iron
	3748	97,800	6	Cast Iron
	3749	97,000	6	Cast Iron
	3750	98,100	6	Cast Iron
	3751	97,200	6	Cast Iron
	3752	97,500	6	Cast Iron
	3753	97,800	6	Cast Iron
	3754	96,700	6	Cast Iron
	3755	98,500	6	Cast Iron
	3756	97,470	6	Cast Iron
	3757	104,900	6	Cast Iron
	3758	106,200	6	Cast Iron
	3759	106,100	6	Cast Iron
	3760	107,600	6	Cast Iron
	3761	104,700	6	Cast Iron
	3762	105,000	6	Cast Iron
	3763	105,900	6	Cast Iron
	3764	106,700	6	Cast Iron
	3765	103,700	6	Cast Iron
	3766	100,200	6	Cast Iron
	3767	105,300	6	Cast Iron
	3768	106,000	6	Cast Iron
	3769	109,100	6	Cast Iron
	3770	109,100	6	Cast Iron
	3799	93,700	6	Cast Iron
Coach (Steel)	3800	121,400	6	Steel
	3801	121,800	6	Steel
	3802	119,700	6	Steel
	3803	121,900	6	Steel
	3804	121,200	6	Steel
	3805	120,700	6	Steel
	3806	120,500	6	Steel
	3807	119,800	6	Steel
	3809	119,900	6	Steel
	3810	119,500	6	Steel
	3811	121,200	6	Steel
	3813	119,900	6	Steel
	3814	119,700	6	Steel
	3900	117,500	6	Steel
	3901	116,100	6	Steel
	3902	116,100	6	Steel
	3903	115,100	6	Steel
	3904	115,900	6	Steel
	3905	118,600	6	Steel
	3906	116,100	6	Steel
	3907	116,400	6	Steel
	3908	116,500	6	Steel
	3909	116,200	6	Steel
Coach (Steel)	3910	128,800	6	Steel
	3912	121,100	6	Steel
	3913	121,400	6	Steel
	4150	131,000	6	Steel
	4151	130,600	6	Steel
	4152	139,300	6	Steel
	4153	128,900	6	Steel
	4154	128,800	6	Steel
	4155	129,400	6	Steel
	4156	109,300	6	Steel
	4157	128,600	6	Steel

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	4158	128,100	6	Steel
	4159	129,100	6	Steel
	4160	130,100	6	Steel
	4161	130,600	6	Steel
	4162	128,000	6	Steel
	4163	130,000	6	Steel
	4164	128,700	6	Steel
	4165	128,500	6	Steel
	4166	127,200	6	Steel
	4167	128,400	6	Steel
	4168	128,700	6	Steel
	4169	129,300	6	Steel
	4170	137,700	6	Steel
	4171	128,700	6	Steel
	4200	133,300	6	Steel
	4201	135,600	6	Steel
	4202	134,100	6	Steel
	4203	135,500	6	Steel
	4204	136,700	6	Steel
	4205	135,900	6	Steel
	4206	134,900	6	Steel
	4207	134,000	6	Steel
	4208	134,700	6	Steel
	4209	134,200	6	Steel
	4210	133,000	6	Steel
	4211	135,900	6	Steel
	4212	132,200	6	Steel
	4213	134,300	6	Steel
	4214	134,500	6	Steel
	4215	132,700	6	Steel
	4216	133,400	6	Steel
	4217	133,100	6	Steel
	4218	134,400	6	Steel
	4219	132,600	6	Steel
	4220	134,600	6	Steel
	4221	134,000	6	Steel
	4222	135,000	6	Steel
	4223	134,900	6	Steel
	4224	133,300	6	Steel
	4226	131,900	6	Steel
	4227	128,000	6	Steel
	4229	124,000	6	Steel
	4230	126,000	6	Steel
	4231	128,600	6	Steel
	4232	126,000	6	Steel
	4233	128,000	6	Steel
Coach (Steel)	4234	126,100	6	Steel
	4235	127,600	6	Steel
	4236	127,900	6	Steel
	4237	129,100	6	Steel
	4238	129,100	6	Steel
	4239	129,000	6	Steel
	4240	129,700	6	Steel
	4241	128,200	6	Steel
	4242	128,100	6	Steel
	4243	129,000	6	Steel
	4244	128,700	6	Steel
	4245	127,300	6	Steel
	4246	128,200	6	Steel
	4247	130,000	6	Steel

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	4248	128,500	6	Steel
	4249	127,300	6	Steel
	4250	128,000	6	Steel
	4251	128,100	6	Steel
	4252	129,900	6	Steel
	4253	131,000	6	Steel
	4254	126,900	6	Steel
	4256	128,700	6	Steel
	4257	128,700	6	Steel
	4260	127,400	6	Steel
	4261	131,200	6	Steel
	4262	129,000	6	Steel
	4263	127,600	6	Steel
	4264	128,800	6	Steel
	4265	128,900	6	Steel
	4266	131,900	6	Steel
	4267	133,200	6	Steel
	4268	125,000	6	Steel
	4269	132,600	6	Steel
	4270	132,200	6	Steel
	4271	134,200	6	Steel
	4272	131,900	6	Steel
	4273	131,600	6	Steel
	4274	132,700	6	Steel
	4275	131,700	6	Steel
	4276	131,100	6	Steel
	4277	131,600	6	Steel
	4278	133,600	6	Steel
	4279	131,200	6	Steel
	4280	130,900	6	Steel
	4281	131,700	6	Steel
	4282	131,900	6	Steel
	4283	133,500	6	Steel
	4284	132,900	6	Steel
	4285	129,800	6	Steel
	4286	141,400	6	Steel
	4287	130,500	6	Steel
	4288	139,300	6	Steel
	4289	139,100	6	Steel
	4290	140,600	6	Steel
	4291	142,000	6	Steel
	4292	140,700	6	Steel
	4293	144,300	6	Steel
Chair Car (Wood)	4602	93,900	6	Cast Iron
	4603	93,900	6	Cast Iron
	4606	106,500	6	Cast Iron
Chair Car (Steel)	4700	133,200	6	Steel
	4701	132,900	6	Steel
	4702	141,400	6	Steel
	4703	144,800	6	Steel
Diner (Wood)	5000	97,700	6	Steel
	5001	93,300	6	Steel
	5002	102,300	6	Steel
	5003	99,000	6	Steel
	5004	131,700	6	Steel
	5005	131,800	6	Steel
	5006	126,900	6	Steel
	5007	131,500	6	Steel
	5008	130,500	6	Steel
	5009	130,600	6	Steel

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	5010	130,200	6	Steel
	5011	128,800	6	Steel
	5012	134,000	6	Steel
	5013	138,800	6	Steel
	5014	141,000	6	Steel
	5015	135,200	6	Steel
Diner (Steel)	5100	157,600	6	Steel
	5101	160,300	6	Steel
	5102	157,700	6	Steel
	5103	158,800	6	Steel
	5104	159,800	6	Steel
	5105	156,600	6	Steel
	5106	154,500	6	Steel
	5107	161,500	6	Steel
	5108	157,200	6	Steel
	5109	160,400	6	Steel
	5110	160,200	6	Steel
	5111	151,900	6	Steel
	5112	161,300	6	Steel
	5113	151,300	6	Steel
	5114	151,700	6	Steel
	5115	156,500	6	Steel
	5116	156,000	6	Steel
	5117	157,300	6	Steel
	5118	157,300	6	Steel
	5119	158,300	6	Steel
	5120	158,400	6	Steel
	5121	161,700	6	Steel
	5122	158,700	6	Steel
	5123	160,600	6	Steel
	5124	161,900	6	Steel
	5125	160,600	6	Steel
	5126	160,400	6	Steel
	5127	159,600	6	Steel
	5128	161,400	6	Steel
	5129	152,900	6	Steel
	5130	151,700	6	Steel
Tourist (Wood)	5300	77,800	6	Steel
	5301	77,800	6	Steel
	5302	76,900	6	Steel
	5303	79,900	6	Steel
Tourist (Steel Underframe)	5501	139,400	6	Steel
	5502	143,500	6	Steel
	5503	117,200	6	Steel
Tourist (Steel)	5700	155,200	6	Steel
	5701	154,300	6	Steel
	5702	164,200	6	Steel
	5703	154,400	6	Steel
	5704	142,700	6	Steel
	5705	143,200	6	Steel
	5706	142,000	6	Steel
	5707	143,800	6	Steel
	5708	143,900	6	Steel
	5709	144,700	6	Steel
	5710	142,500	6	Steel
	5711	145,200	6	Steel
	5712	154,600	6	Steel
	5713	154,600	6	Steel
	5714	153,600	6	Steel
	5715	153,500	6	Steel

Car	Number	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
	5716	152,600	6	Steel
	5717	154,900	6	Steel
	5718	145,000	6	Steel
	5719	146,100	6	Steel
	5720	142,800	6	Steel
	5721	144,900	6	Steel
	5722	145,500	6	Steel
	5723	143,900	6	Steel
	5724	144,300	6	Steel
	5725	144,700	6	Steel
	5726	140,600	6	Steel
	5727	144,200	6	Steel
	5728	143,400	6	Steel
Business (Wood)	5800	92,600	6	Steel
	5801	92,400	6	Steel
(Mine Rescue)	5802	75,300	6	Cast Iron
	5803	73,200	6	Cast Iron
	5804	50,000	4	Cast Iron
	5805	54,200	6	Cast Iron
	5806	66,700	6	Cast Iron
	5807	78,100	6	Cast Iron
	5808	56,100	4	Cast Iron
	5809	73,900	6	Cast Iron
	5811	102,100	6	Steel
	5812	62,000	4	Cast Iron
	5813	62,500	4	Cast Iron
	5814	62,700	4	Cast Iron
	5815	64,900	4	Cast Iron
	5816	64,900	4	Cast Iron
	5817	99,800	6	Steel
	5850	96,000	6	Steel

Name of Car	Kind	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Aberdeen.....	Par.	96,600	6	Steel
Agawam.....	Obs.	153,800	6	Steel
Alaska.....	Obs.	159,000	6	Steel
Alberton.....	Obs.	159,700	6	Steel
Alcazar.....	Obs.	152,100	6	Steel
Aleutian.....	Obs.	160,800	6	Steel
Alexandria.....	Open Obs.	60,000	6	Steel
Alta Vista.....	Open Obs.	61,300	6	Steel
America.....	Open Obs.	61,000	6	Steel
Anaconda.....	Obs.	162,000	6	Steel
Anamosa.....	Obs.	147,800	6	Steel
Arbor Vitae.....	Obs.	158,400	6	Steel
Arbutus.....	Obs.	153,100	6	Steel
Arcadia.....	Obs.	146,800	6	Steel
Arequipa.....	Obs.	154,700	6	Steel
Ashford.....	Obs.	150,100	6	Steel
Austin.....	Slpr.	154,700	6	Steel
Avalon.....	Slpr.	133,100	6	Steel
Beaver Dam.....	Slpr.	157,300	6	Steel
Beloit.....	Slpr.	120,300	6	Steel
Beulah.....	Slpr.	160,100	6	Steel
Beverly.....	Par.	149,400	6	Steel
Bonaire.....	Slpr.	152,000	6	Steel
Bristol.....	Slpr.	142,200	6	Steel
Buena.....	Par.	147,200	6	Steel

Name of Car	Kind	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Buena Vista.....	Obs.	163,400	6	Steel
Butte.....	Slpr.	157,100	6	Steel
Calabar.....	Slpr.	135,400	6	Steel
Calmar.....	Slpr.	153,200	6	Steel
Calumet.....	Slpr.	130,000	6	Steel
Cambria.....	Slpr.	153,300	6	Steel
Cascade.....	Slpr.	151,300	6	Steel
Chaska.....	Slpr.	131,600	6	Steel
Chatcolet.....	Slpr.	154,000	6	Steel
Chateau.....	Slpr.	150,400	6	Steel
Chenequa.....	Slpr.	127,000	6	Steel
Chicago.....	Slpr.	90,700	6	Cast Iron
Cle Elum.....	Obs.	153,200	6	Steel
Columbia.....	Obs.	160,500	6	Steel
Columbus.....	Slpr.	151,800	6	Steel
Como.....	Obs.	131,100	6	Steel
Cordova.....	Slpr.	93,000	6	Cast Iron
Corliss.....	Slpr.	154,600	6	Steel
Couer D'Alene.....	Slpr.	152,500	6	Steel
Dakota.....	Slpr.	128,300	6	Steel
Davenport.....	Slpr.	159,700	6	Steel
Deer Lodge.....	Slpr.	159,200	6	Steel
Des Moines.....	Slpr.	125,400	6	Steel
Eagel.....	Par.	124,900	6	Steel
Edgebrook.....	Slpr.	152,000	6	Steel
Edgewater.....	Slpr.	99,800	6	Steel
Elkhart.....	Par.	121,900	6	Steel
Ellendale.....	Slpr.	102,200	6	Steel
Ellensburg.....	Slpr.	153,900	6	Steel
Enumclaw.....	Obs.	153,600	6	Steel
Eureka.....	Slpr.	152,900	6	Steel
Everett.....	Slpr.	151,300	6	Steel
Ewayea.....	Slpr.	127,700	6	Steel
Excelsior.....	Slpr.	148,200	6	Steel
Fairmont.....	Slpr.	152,200	6	Steel
Faribault.....	Slpr.	100,300	6	Steel
Farmington.....	Slpr.	125,300	6	Steel
Flambeau.....	Slpr.	129,800	6	Steel
Fontana.....	Par.	147,600	6	Steel
Ft. Snelling.....	Slpr.	99,200	6	Steel
Freeport.....	Slpr.	151,700	6	Steel
Garrison.....	Slpr.	156,400	6	Steel
Geneva.....	Par.	124,800	6	Steel
Genoa.....	Slpr.	148,100	6	Steel
Glacier.....	Obs.	158,000	6	Steel
Glencoe.....	Slpr.	152,600	6	Steel
Glen Ellyn.....	Slpr.	129,400	6	Steel
Glenora.....	Slpr.	155,600	6	Steel
Glenview.....	Slpr.	160,600	6	Steel
Great Falls.....	Slpr.	151,600	6	Steel
Hampshire.....	Slpr.	92,600	6	Cast Iron
Harlowton.....	Slpr.	167,900	6	Steel
Hartford.....	Slpr.	153,900	6	Steel
Hartland.....	Slpr.	103,400	6	Steel
Hiawatha.....	Slpr.	131,000	6	Steel
Illinois.....	Slpr.	78,100	6	Cast Iron
Ingomar.....	Slpr.	151,400	6	Steel
Ipswich.....	Slpr.	148,100	6	Steel
Irma.....	Slpr.	149,400	6	Steel
Ismay.....	Slpr.	142,400	6	Steel

Name of Car	Kind	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Janesville	Par.	120,300	6	Steel
Juneau	Par.	122,400	6	Steel
Juaniata	Slpr.	159,600	6	Steel
Kansas City	Slpr.	159,400	6	Steel
Kapowsin	Obs.	149,700	6	Steel
Kasota	Slpr.	158,700	6	Steel
Kegonsa	Obs.	124,200	6	Steel
Kenilworth	Par.	147,000	6	Steel
Kilbourn	Slpr.	79,700	6	Cast Iron
Kiowa	Slpr.	133,200	6	Steel
Kittitas	Slpr.	149,200	6	Steel
Kootenai	Slpr.	156,900	6	Steel
Kuchelus	Slpr.	164,100	6	Steel
La Crescent	Slpr.	150,700	6	Steel
La Crosse	Slpr.	129,800	6	Steel
La Vista	Slpr.	155,400	6	Steel
Lakeland	Obs.	154,700	6	Steel
Lake Pepin	Slpr.	103,400	6	Steel
Lakeside	Slpr.	100,800	6	Steel
Leota	Slpr.	116,000	6	Steel
Lewistown	Slpr.	157,900	6	Steel
Liberty	Par.	147,200	6	Steel
Lisbon	Slpr.	154,700	6	Steel
Luana	Slpr.	130,100	6	Steel
Lucerne	Open Obs.	60,000	6	Steel
Madison	Slpr.	84,300	6	Cast Iron
Magenta	Slpr.	126,500	6	Steel
Mahto	Obs.	154,100	6	Steel
Malden	Slpr.	156,600	6	Steel
Manawa	Slpr.	156,000	6	Steel
Manilla	Slpr.	155,800	6	Steel
Manitoba	Slpr.	73,800	6	Cast Iron
Mankato	Slpr.	126,200	6	Steel
Maquoketa	Obs.	153,100	6	Steel
Marathon	Slpr.	148,700	6	Steel
Marcellus	Slpr.	151,400	6	Steel
Marengo	Slpr.	150,900	6	Steel
Marion	Slpr.	152,000	6	Steel
Markesan	Slpr.	154,600	6	Steel
Marmarth	Slpr.	153,500	6	Steel
Marquette	Slpr.	128,600	6	Steel
Massilon	Slpr.	158,800	6	Steel
Melbourne	Slpr.	80,000	6	Cast Iron
Melstone	Slpr.	154,700	6	Steel
Mendota	Slpr.	151,000	6	Steel
Merrill	Slpr.	154,500	6	Steel
Miles City	Slpr.	152,300	6	Steel
Miloma	Slpr.	154,900	6	Steel
Milwaukee	Bus.	190,500	6	Steel
Minneapolis	Slpr.	90,600	6	Steel
Minnehaha	Slpr.	124,100	6	Steel
Minneiska	Par.	150,300	6	Steel
Minnekahda	Slpr.	128,000	6	Steel
Minneola	Par.	148,400	6	Steel
Minnetonka	Slpr.	121,100	6	Steel
Minnewaukon	Slpr.	127,900	6	Steel
Minocqua	Slpr.	103,900	6	Steel
Miscowaubik	Obs.	137,100	6	Steel
Mississippi	Slpr.	115,800	6	Steel
Missoula	Slpr.	145,000	6	Steel

Name of Car	Kind	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
Missouri.....	Obs.	153,500	6	Steel
Mobridge.....	Slpr.	156,800	6	Steel
Moline.....	Slpr.	151,500	6	Steel
Monona.....	Slpr.	127,400	6	Steel
Montana.....	Slpr.	150,500	6	Steel
Montevideo.....	Obs.	131,500	6	Steel
Moravia.....	Slpr.	155,200	6	Steel
Mosinee.....	Slpr.	152,500	6	Steel
Mt. Hood.....	Slpr.	154,400	6	Steel
Mystic.....	Slpr.	153,400	6	Steel
Nahma.....	Slpr.	128,700	6	Steel
Nashota.....	Slpr.	96,700	6	Steel
Nebraska.....	Slpr.	157,800	6	Steel
Nekoosa.....	Obs.	128,300	6	Steel
Neola.....	Slpr.	98,500	6	Steel
Newburgh.....	Slpr.	82,600	6	Cast Iron
New York.....	Slpr.	80,900	6	Cast Iron
Necedah.....	Slpr.	108,200	6	Steel
Niobrara.....	Slpr.	78,500	6	Cast Iron
Nisqually.....	Slpr.	149,700	6	Steel
Nokomis.....	Slpr.	123,100	6	Steel
Noquebay.....	Slpr.	126,200	6	Steel
Numids.....	Slpr.	97,400	6	Steel
Oconomowoc.....	Slpr.	81,200	6	Cast Iron
Oconto.....	Slpr.	155,100	6	Steel
Okabena.....	Slpr.	105,000	6	Steel
Omaha.....	Slpr.	156,100	6	Steel
Omro.....	Slpr.	156,400	6	Steel
Onalaska.....	Slpr.	130,400	6	Steel
Oneida.....	Slpr.	142,700	6	Steel
Ontonagon.....	Slpr.	128,000	6	Steel
Orient.....	Slpr.	158,700	6	Steel
Orleans.....	Slpr.	156,600	6	Steel
Osseo.....	Slpr.	132,400	6	Steel
Othello.....	Slpr.	154,700	6	Steel
Ottumwa.....	Slpr.	124,800	6	Steel
Owatona.....	Slpr.	96,600	6	Cast Iron
Pacific.....	Slpr.	78,000	6	Steel
Palmyra.....	Slpr.	101,600	6	Steel
Panama.....	Slpr.	150,000	6	Steel
Pewaukee.....	Slpr.	97,600	6	Steel
Piedmont.....	Obs.	151,600	6	Steel
Ponca.....	Slpr.	149,600	6	Steel
Portage.....	Slpr.	127,800	6	Steel
Portland.....	Slpr.	148,600	6	Steel
Puyallup.....	Slpr.	151,000	6	Steel
Racine.....	Slpr.	148,600	6	Steel
Rainier.....	Par.	152,600	6	Steel
Rubio.....	Slpr.	148,400	6	Steel
Rutledge.....	Slpr.	148,600	6	Steel
Rockaway.....	Slpr.	150,000	6	Steel
Rock Island.....	Slpr.	152,000	6	Steel
Rockford.....	Slpr.	101,600	6	Steel
Red Wing.....	Slpr.	78,000	6	Steel
Rubicon.....	Slpr.	76,200	6	Steel
Ramona.....	Slpr.	114,200	6	Steel
Ripon.....	Par.	141,000	6	Steel
Romadka.....	Slpr.	153,000	6	Steel
St. Joe.....	Slpr.	152,600	6	Steel
St. Maries.....	Slpr.	153,400	6	Steel

Name of Car	Kind	Light Weight Lbs.	No. of Wheels Per Truck	Kind of Wheels
St. Regis.....	Slpr.	153,600	6	Steel
Seattle.....	Slpr.	154,000	6	Steel
Smyrna.....	Slpr.	154,000	6	Steel
Spokane.....	Slpr.	148,000	6	Steel
Sioux.....	Slpr.	121,600	6	Steel
Sioux City.....	Slpr.	125,800	6	Steel
Sioux Falls.....	Slpr.	134,600	6	Steel
Sabula.....	Slpr.	71,400	6	Cast Iron
Savanna.....	Slpr.	71,000	6	Cast Iron
Snohomish.....	Obs.	151,000	6	Steel
Superior.....	Slpr.	155,600	6	Steel
Superba.....	Slpr.	155,400	6	Steel
Sparta.....	Par.	114,600	6	Steel
St. Paul.....	Bus.	122,000	6	Steel
Snoqualmie.....	Bus.	103,800	6	Steel
Tacoma.....	Slpr.	143,000	6	Steel
Tekoa.....	Slpr.	151,200	6	Steel
Tomah.....	Slpr.	129,000	6	Steel
Tomahawk.....	Slpr.	121,400	6	Steel
Vancouver.....	Slpr.	150,800	6	Steel
Vesper.....	Slpr.	149,600	6	Steel
Victoria.....	Slpr.	152,000	6	Steel
Valencia.....	Slpr.	89,600	6	Steel
Viroqua.....	Slpr.	106,000	6	Steel
Valdora.....	Obs.	120,000	6	Steel
Ventura.....	Obs.	120,000	6	Steel
Waubay.....	Slpr.	148,600	6	Steel
Wyoming.....	Slpr.	148,600	6	Steel
Waubena.....	Slpr.	130,200	6	Steel
Wausau.....	Slpr.	128,400	6	Steel
Winona.....	Slpr.	118,800	6	Steel
Waukesha.....	Slpr.	81,200	6	Steel
Wakpala.....	Obs.	148,000	6	Steel
Westport.....	Slpr.	154,600	6	Steel
Wyandotte.....	Slpr.	162,000	6	Steel
Whitewater.....	Par.	147,400	6	Steel
Watertown.....	Par.	100,200	6	Steel
Wyocena.....	Par.	113,600	6	Steel
Waucoma.....	Obs.	145,000	6	Steel
Wauwatosa.....	Buff.	156,000	6	Steel
Winneconne.....	Obs.	156,400	6	Steel
Wanamingo.....	Obs.	121,200	6	Steel
Winnebago.....	Obs.	122,000	6	Steel
Woodland.....	Obs.	141,400	6	Steel
Waubesa.....	Obs.	113,800	6	Steel
Wisconsin.....	Bus.	143,800	6	Steel
Walworth.....	Bus.	165,400	6	Steel
Yakima.....	Slpr.	150,000	6	Steel
Yukon.....	Slpr.	151,800	6	Steel
Zumbrota.....	Slpr.	100,100	6	Steel
Zenda.....	Par.	142,400	6	Steel

Para. 5

ABBREVIATIONS FOR STATIONS

The following abbreviations will be used by the points concerned in sending telegrams, stencilling cars, etc.:

Aberdeen	Abdn.	Madrid	Madr.
Alberton	Albtn.	Malden	Mldn.
Atkins	Atkn.	Manilla	Mnlla.
Aurora	Auror.	Mankato	Mnkto.
Austin	Austn.	Mannheim	M/heim
Avery	Avery	Mapleton	Mpletn.
Bedford	Bedf.	Marion	Marn.
Bellevue	Belvue.	Marmarth	Mrmth.
Bellingham	Belhm.	Marquette	M/qte.
Beloit	Belt.	Mason City	M. Cty.
Bensenville	Bnvl.	Mayville	Mayvl.
Boville	Bovl.	McIntosh	McInt.
Bristol	Brstl.	Melstone	Melstn.
Butte	Butte	Menasha	Mensh.
Calmar	Calmr.	Mendota	Mndta.
Canton	Cantn.	Menominee	Mnmne.
Cedar Falls	C. Flls.	Merrill	Merl.
Cedar Rapids	C. Rpds.	Milbank	Milbk.
Chamberlain	Chbln.	Miles City	Mile C.
Champion	Chmpn.	Milwaukee—Coach Yd.	Milw. CY
Channing	Chng.	Milwaukee—Davies Yd.	Davies
Chicago	Chgo.	Milwaukee—Shops	Milw. Shp.
Chicago Union Station	Chgo. U. Sta.	Milwaukee—Terminals	Milw. Tl.
Chicago—Division St.	Div. St.	Mineral	Minl.
Chicago—Kenzie St.	Kenz. St.	Mineral Point	Min Pt.
Chicago—Union St.	Un. St.	Minneapolis—Bass Lake	} Mpls.
Cle Elum	CleE.	Minneapolis—Coach Yd.	
Coburg	Cobg.	Minneapolis—Shops	
Corliss	Corls.	Minocqua	Minqa.
Council Bluffs	CBlffs.	Mitchell	Mitch.
Davenport	Dvnpt.	Mobridge	Mobr.
Davis Junction	Dav. Jt.	Montevideo	MonteV.
Deer Lodge	D. Lodg.	Momence	Momce.
De Kalb	D. Kalb	Murdo	Murdo.
Delmar Junction	Del. Jt.	Mystic	Mystic.
Dubuque	Dubq.	Nahant	Nht.
East Moline	E. Mol.	New Lisbon	N Lisb.
Eau Claire	EauC.	Ontonagon	Ontgn.
Ellis Jct.	Ell. Jt.	Ortonville	Ort/vll.
Escanaba	Esc.	Othello	Othll.
Everett	Evt.	Ottumwa Jct.	Ott. Jt.
Faithorn	Fthn.	Oxford Junction	Axf. Jt.
Fargo	Fargo	Perry	Perry
Faribault	Farbt.	Portage	Ptge.
Farmington	Fmgtn.	Port Angeles	Pt Angl.
Ferguson	Fergn.	Racine	Racne.
Freeport	Frept.	Rapid City	Rap Cy.
Galewood Yd. 1	Galw. I	Raymond	Raymd.
Galewood Yd. 2	Galw. II	Red Wing	Rd Wng.
Galewood Yd. 3	Galw. III	Rockford	Rkfd.
Granville	Grvll.	Rock Island	Rok Is.
Great Falls	GFlls.	Rockwell City	Rok Cy.
Green Bay	GBay.	Roundout	Rondt.
Harlowton	Harltn.	Roundup	Rndp.
Hastings	Hstngs.	Sanborn	Sanbn.
Herndon	Hrndn.	Savanna	Sav.
Hilbert Junction	Hil. Jt.	Seattle	Sttle.
Horicon	Horcn.	Seymour	Symr.
Independence	Indp.	Sidnaw	Sdnaw.
Iron Mountain	I. Mtn.	Sioux City	Soo Cy.
Iron River	I. Riv.	Sioux Falls	Soo F.
Jackson	Jcksn.	Sparta	Sprta.
Janesville	Jnsvll.	Spaulding	Spldg.
Joliet	Jolt.	Spencer	Spncr.
Judith Gap	Jud. Gp.	Spirit Lake	Sp Lke.
Kapowsin	Kpsin.	Spokane	Spkne.
Kirkland	Kirkld.	St. Maries	St. Mrs.
LaCrosse	LaX.	St. Paul	St. P.
Ladd	Ladd	Tacoma	Tac.
Laredo	Lrdo.	Terre Haute	THte.
Latta	Latta	Three Forks	3 Fork
Lewistown	L/town	Tomah	Tomah
Madison, S. D.	Mad. S. D.	Tomahawk	Tmhk.
Madison, Wis.	Mad. W.	Tripp	Tripp

Wabasha	Wbsha.	West Clinton	W. Cln.
Watertown	Wtrtn.	Western Avenue	W. Ave.
Waukesha	Wauksh.	Winona	Wnona.
Wausau	Wausa.	Wisconsin Rapids	Wis Rpds.
Wells	Wells	Yankton	Yktn.

SECTION IX

INSPECTION REPORTS AND RECORDS

Para. 1

975 REPORT

This is to be made out by the inspector, chief inspector, or foreman at all No. 1 or No. 2 inspection points for every train departing from or passing through the station concerned.

The object of this form is to guarantee the proper inspection and safe condition of the equipment and to obtain the benefit of the train crews' experience with the trains while on the road. Any defects shown on this form must be properly corrected and the car inspector at the inbound station is to make certain that ample assistance is provided to correct any of the defects reported by the conductor on this form so that it will not be necessary for him, in filling out this form for the outbound movement of the train, to include any of the defects previously reported. This form is to be made out in duplicate, and car inspector will in case of freight trains place in suitable box located on end of cabooses for this purpose two blanks with carbon paper between, all placed on a suitable board and of same dimensions as the report and held in place by a rubber band near the top. In the case of passenger trains the report will be handed to the conductor. On arrival at inbound station the car inspector will meet the train and receive Form 975, and will note thereon the number of brakes cut out and sign the report in the space provided. He will at this time note whether the brakes cut out have air brake defect cards attached. He will also look over the report to see whether conductor has reported any difficulty with train while in his possession, and if any trouble is reported same must be corrected immediately if feasible. The original of the report must then be forwarded to the division superintendent and the duplicate retained by the local car foreman in charge of the station at which train arrives. These copies must be kept in neat order so as to be readily accessible in the event it is desired to look up record on any train arriving at the station. It should be understood that these reports are to be used on all divisions and are to cover the operation of a train from one terminal to the next terminal and where a train goes through several terminals, the car inspector will arrange to supply new forms to the conductor taking charge of train leaving station. In other words, the one form is not to be carried through from the originating station to the final terminal, but is to be carried only so far as each divisional terminal where train crews change.

Para. 2 TAGS INDICATING CARS ARE BAD ORDER

The tag we have in use is a red card printed in black, and is to be applied to both sides of a car.

When it is found that these cards are being removed by unauthorized persons, a check is to be made, and whoever is responsible for their wrong

removal will be reported to the Master Car Builder through the correct channels. This will be done by ordinary letter, but the matter must not be handled locally, but reported as laid down.

For details see Para. 5 of Section I.

Para. 3 **REPORTING INFRINGEMENT OF RULE 26**

The necessity for complying with the rule governing the use of the blue flag cannot be too strongly impressed upon all concerned. (See Para. 1 of Section I.) When infringement occurs the matter is to be reported through the correct channels to the Master Car Builder, whether responsibility is placed or not. This is in order that at places where constant abuse prevails special steps may be taken to discover the source of trouble and stop it.

Report will be made by ordinary letter.

Para. 4 **SAFETY APPLIANCE REPORTS**

When government inspectors visit a point they usually call upon the foreman or whoever is in charge, before going over the equipment. If possible the person in charge of a point should accompany them during their inspection, but failing this a foreman or inspector will be delegated to go around with the I. C. C. representatives.

As soon as the inspection is completed a report as per form shown below is to be made direct to the Master Car Builder, and a copy sent to the general safety appliance inspector. Copies will also be made for local and district requirements.

No delay must occur in sending this report in, and *it is to be complete*. Names of inspectors for each defect must invariably be included, and under column "Discipline Applied" recommendation made either that no action be taken and why, or that action be taken and what it should consist of (demotion, demerit marks applied, etc.).

C. M. & ST. P. RAILWAY COMPANY

REPORT OF DEFECTS

FOUND BY I. C. C. INSPECTOR OF SAFETY APPLIANCES

Car or Engine Number	Defect found	Date defect Repaired	Inspectors Responsible	Discipline Applied
Remarks:—				
Station	Number of cars inspected			
Date	Number found defective			
Time inspection began	Percent defective			
Time inspection finished	Percentage defective			
Name of I. C. C. inspector	last inspection			
	..... Foreman			

Para. 5**WHEEL REPORTS****Sub-Para. (I)****GUARANTEED CAST WHEELS**

Reference to Sub-Para. xxii, Para. 9 of Section I will give information required to be contained in regular monthly reports, to be furnished by all shop points, showing wheels removed that were in service less than the guaranteed period. Report will be made out in letter form, headed "Failure of Guaranteed Cast Iron Wheels," and one copy sent to District headquarters, and one copy retained on file.

Sub-Para. (II)**WHEELS SCRAPPED UNNECESSARILY**

Milwaukee foundry will render periodical reports of wheels removed and scrapped that are found fit for further service. The matter will be taken up by letter by the master car builder's office, with the point concerned, for correction.

Para. 6**FORM 661-B—BAD ORDER CAR AND
INSPECTION RECORD**

This form is to be filled in for all cars (freight, passenger and caboose) in bad order, which are set out of trains and marked for repair track and for all cars received in interchange. One copy only to be made and to be filled out at time and place car is inspected. It is necessary that all of the headings be filled in as called for in spaces provided for, so that a complete record will be available. At points where required by local conditions the seal record must be obtained and numbers of seals on right and left side of car shown, the seal record to be filled in in the spaces provided for. For cars received in interchange the inspectors will fill out one of the forms for each car and note the defects existing, indicating whether defects are old or new, and if there are no defects on car indicate same by writing in the initials "O. K."

Exceptions: At Chicago, Omaha, Kansas City and Twin Cities, where joint inspection bureaus are established, the bureau instructions covering the keeping of interchange records will govern. The object of this record is to enable car foremen to refer to same when called upon to give record of cars marked bad order and of cars received in interchange in bad order or otherwise.

(Note.—The use of books of any description for recording information called for on Form 661-B will not be permitted.

The filing of Form 661-B is to be handled as follows:

Filing cases containing 100 spaces are to be provided at each point for the filing of this record. Such cases will be numbered 00 to 99, inclusive, and will be made and numbered as provided for on blue print to be furnished. The forms will be filed in such cases in accordance with the last two figures of car number, for instance—form for car 26578 would be placed in space number 78. Care should be taken to keep the records in each space in date order. The last date to be placed on top, and when any of these records are taken out for reference care must be taken to see

that they are placed back in proper space and as to date order. It should also be understood that it is not the intention to file Form 661-B with Form 661-A, or any other records; in fact, same must be kept filed in separate filing cases as herein provided for.)

Para. 7 .FORM 619—A. R. A. JOINT EVIDENCE CARD

When a system car is received from a connecting line and the inspector at the interchange point finds that improper repairs have been made, he will call on an inspector for one of the connecting lines to make joint inspection. The joint evidence card, Form 619, is to be used for this purpose, and under the head of description of wrong repairs, all items of wrong repairs are to be noted, showing information as to sizes of wrong material or kind, etc., and under the head of "how repairs should have been made," information should be shown as to what is standard to the car. This card is then to be signed by the inspector for this road and by the inspector for some other railroad subscriber to the A. R. A. Interchange Rules, or at points where there is a joint inspector, the signature of the joint inspector is all that is necessary.

On the reverse side of Form 619 the inspector will show opposite "disposition of car," name of shop to which car is forwarded after wrong repairs have been corrected, or, name of shop car is forwarded without repairs having been corrected. If the wrong repairs are not corrected at the interchange point the joint evidence card must be attached to the car as per instructions contained in third paragraph of A. R. A. Rule 14.

Inspectors at interchange points must be very careful to see that the joint evidence card is attached to the car if repairs are not made at the interchange point and the card must not be removed at any other repair point unless the wrong repairs are corrected.

While it is desirable that this joint evidence card be obtained at the time car is received from connecting line, yet if the car should pass the interchange point and wrong repairs are not detected and car later on shows up at one of the repair points on the system, the car foreman will arrange for joint inspection and fill out the form as herein instructed, obtaining signature of an inspector representing another railroad at such point.

Para. 8 FORM 620—A. R. A. DEFECT CARD

See A. R. A. Rule 14 which covers fully the use of the defect card.

When defect cards are issued they must be filled in on both sides and must plainly specify in full each item, indicating the location as provided for in Rule 14.

When cars are received in interchange car inspectors shall procure defect card covering all delivering line defects as shown below:

All damage as defined in Rule No. 32.
Missing dome covers per Rule No. 32.

Missing safety valves per Rule No. 32.

Missing friction draft gear, also if wood block has been substituted per Rule No. 95.

Missing journal bearings per Rule No. 65.

Missing brake cylinders per Rule No. 58.

Missing reservoirs per Rule No. 58.

Missing triple valves per Rule No. 58.

Missing retaining valves per Rule No. 58.

Missing cut-out cocks per Rule No. 58.

Missing angle cocks per Rule No. 58.

Missing air hose per Rule No. 58.

Missing dirt collectors when cars are stencilled to show so equipped per Rule No. 59.

Wooden brake beams in place of metal per Rule No. 56.

Cars not equipped with A. R. A. standard $1\frac{3}{8}$ " air brake hose per Rule No. 57.

Temporary advertisements per Rule No. 36.

Bent axles per Rule No. 84.

Cut journals per Rule No. 84.

Slid flat wheels if spot is $2\frac{1}{2}$ " or over in length, or if there are two or more adjoining spots, each 2" or over in length in A. R. A. Rule No. 68.

Cars intended to be equipped with wrought steel or steel tired wheels and so stencilled, if found with cast iron or cast steel wheels in A. R. A. Rule No. 70.

Cars intended to be equipped with cast steel wheels and so stencilled, if found with cast iron wheel in A. R. A. Rule No. 70.

Such defect card must be attached to the car per instructions contained in A. R. A. Rule 14, third paragraph, and when car reaches a repair point and the defects covered by the defect card are repaired, the card is to be removed and attached to the record card, Form 661-A or 661-C and further handled as per instructions governing the use of the repair card, Form 617.

If only part of the defects covered by the defect card are repaired, handle per A. R. A. Rule No. 6.

When cars are delivered to connecting line and have switch chains, as in the case of twin loads, such switch chains should be removed before the cars are delivered or defect card should be obtained from the road to which the cars are delivered to cover the value of the switch chains, the number and length of chains to be specified. It will also be satisfactory where cars are delivered to connecting line equipped with such switch chains to obtain from the connecting line an equivalent number of switch chains. However, inspectors must be careful to see that they obtain from the connecting line an equivalent number of switch chains or defect card to cover the value of the chains, and if the connecting line refuses to issue defect card or to return an equivalent number of chains, then switch chains must be removed from the cars before they are delivered.

It is the practice at many of the interchange points for the railroads to furnish material to each other and when this is done defect card is issued to cover the value of material received. Where car foremen furnish material to a connecting line, defect card must be obtained from such connecting line covering the material furnished and this defect card is then to be turned over to the local storekeeper who will render bill for the value of the material.

Para. 9 REPORTS OF CARS HELD FOR DISMANTLING, DISMANTLED, OR DESTROYED

Sub-Para. (I) REPORT OF CARS CONSIDERED FIT FOR DISMANTLING

When a system car is, from any cause, in such condition that it is considered it should be dismantled, the foreman at which point the car is held will report same direct to the Master Car Builder on Form 654-A, which gives a description of the car, estimated cost to repair, and a description of defects. The report in question is to be accompanied by one photograph of the car.

In the case of a foreign car in line for dismantling on account of being worn out, the procedure will be as follows:

When a foreign car is destroyed or badly damaged or found in badly damaged condition and it is not considered advisable to repair, the wrecking foreman or car foreman will immediately wire the Master Car Builder giving initials and car number advising where and when damaged or found damaged. The car foreman at point car was found or brought to from wreck will follow by furnishing a Form CD-3 giving description of car, including stencilled light weight and class of construction per A. R. A. Rule 112, also photograph, and detailed estimated cost of repairs.

All this information to be promptly forwarded direct to Master Car Builder and copy of letter of transmittal to go to district general car foreman.

Master Car Builder will advise local foreman as to what disposition is to be made of car, sending copy of letter to district general car foreman.

When the estimated labor costs to repair a foreign car exceed the limits as shown in A. R. A. Rule 120, the car is to be held for disposition and joint inspection certificate 654, is to be filled out in triplicate showing all repairs required and nature of defects, together with estimated cost of labor and material, separately, on basis of A. R. A. prices.

When more than one blank is required to enumerate repairs each blank is to be numbered starting with number one and the estimated cost for labor and material to be shown on last sheet. The last sheet to be signed by person making the inspection.

When reporting cars for disposition and it is necessary to order plans,

specifications or material from car owners to make repairs if authorized, Form CD-10 must accompany joint inspection certificate 654.

The joint inspection certificate in duplicate with photograph of car will be forwarded direct to the Master Car Builder, who will take up with car owner for disposition, sending copy of his letter to the car accountant, district general car foreman and local car foreman.

Sub-Para. (II) CARS HELD FOR DISMANTLING

On the first and fifteenth of each month a report must be sent direct to the Master Car Builder, showing status of system cars held for dismantling. In order that proper record may be kept of the general situation, this report should be in the following form:

(A)	(B)	(C)
Cars held for which authority has been received to hold for dismantling.	Cars dismantled since last report on authority duly received.	Additional cars for which authority received to hold for dismantling but not previously included in this report.

C. T. H. & S. E. or S. I. cars, for which authority has been received to "hold for further instructions," will be included in this report as if they were held for dismantling.

No report is necessary for foreign cars held for dismantling, for as quickly as authority is received to dismantle a foreign car, the work must be proceeded with on account of the per diem accruing until such time as the car is taken down.

In the past many points have made a habit of allowing their clerks to fill in this report each half month without making any check of the situation and without any attempt to have it agree with the 676 report furnished at the beginning of each month. As a result, many points have continued to report cars held for dismantling after they had been dismantled or after they had been moved to other points with the result that much confusion has occurred in the records at the M. C. B. office and at the car accountant's office in Chicago. It should be borne in mind that this report is used in connection with a check of all system cars which have not moved for a given period and its purpose is defeated unless correctly filled in and ultimately results in much correspondence and unnecessary work in the M. C. B. office and at local points.

Sub-Para. (III) REPORT OF CARS DISMANTLED

When authority has been duly received and a car is finally dismantled, a report is to be made direct to the Master Car Builder as follows:

Form CD-12 covering salvage is to be made out and the following copies are necessary:

Worn out system cars,	3 copies
Worn out foreign cars,	4 copies
System cars destroyed by fire,	4 copies
Foreign cars destroyed by fire,	4 copies
System cars destroyed in wreck,	3 copies
Foreign cars destroyed in wreck,	3 copies

Form CD-12-A (one copy only) is to be rendered for each car dismantled and is to be accompanied by one photograph showing clearly the initials and number of the car. As soon as car is dismantled initials and number will be reported on Form 112, Daily Car Report, and this fact must be duly certified to when filling in Form CD-12-A.

**Para. 10 FORM CD-10—MATERIAL REQUESTED
FROM CAR OWNER**

Reference to Section 2, "Repairs," will give details of instances where it is necessary to hold cars pending receipt of material from car owner (See A. R. A. Rule 122). The procedure in such cases will be for the car foreman to wire the district general car foreman giving initial and car number and items of material required, specifying pattern numbers or other data to enable requisitions to be filled. The wire in question will be confirmed by filling in Form CD-10 which must be mailed on the same day that the telegram is dispatched.

Form CD-10 will also accompany joint inspection certificate (Form 654) when writing up foreign cars for disposition account owner's defect.

In filling out Form CD-10 it must be stated below the items ordered whether repairs necessary are account owner's responsibility, or C. M. & St. P. responsibility. Current instructions in respect to numbers of copies to be made of CD-10 will govern.

**Para. 11 COMMODITY CARDS FOR EMPTY CARS
SENT TO LINES WEST**

From time to time it becomes necessary to order a number of cars sent to Lines West to protect certain lading. When such cars are inspected and picked out they must be properly carded with the commodity card showing classification of car as being fit for the lading for which the car is being sent.

This may appear a trivial matter, but on the other hand it is a very important one. A given number of cars are ordered for say, lumber loading, and a given number for grain loading. Upon arrival on Lines West cars picked out for lumber loading are often repaired and made fit for grain loading, on the assumption that they are the best cars available, whereas during the next day or two cars arrive fit for grain loading without repairs, and the demands for grain having been filled the later cars to arrive are used for lumber loading. This is only one of many features of the handicaps imposed through neglect to follow the instructions, and all points called upon to pick our cars to go to Lines West must bear this in mind

and positively obey the instructions to card each car and to show thereon the commodity loading for which it is intended.

Para. 12 FORM 17-A—CERTIFICATE OF TEST

All points having equipment to test safety valves on tank cars shall after making each test complete Form 17-A in triplicate, forwarding one copy direct to the Bureau of Explosives, using the second copy for billing purposes, and retaining the third on file.

Para. 13 FORM 665

In connection with Paragraph 11 of Section 1 covering the inspection, cleaning and repair of air brakes, a report covering work done is to be rendered monthly on Form 665 by all points fitted up to handle air brake repair work. This report will be made out as soon after the first of each month as practicable and one copy forwarded to the air brake supervisor, Milwaukee shops.

SECTION X

SECTION X—A. R. A. BILLING

Para. 1 GENERAL OUTLINE OF A. R. A. BILLING

A. R. A. billing is the method used by railroads of obtaining payment for repairs made to cars, the property of roads other than the one making the repairs. When cars are in service on a foreign road, the owners are paid by the line using a car a fixed sum per diem, and this obligates the owner to the extent of having to keep his car in serviceable condition. To simplify this an arrangement has been arrived at whereby the road having the car on its line makes the necessary repairs, and bills the owner in accordance with an agreed upon set of rules and charges, known as A. R. A. Code of Rules, revised annually.

Para. 2 GENERAL PROCEDURE ON OUR ROAD

Sub-Para. (I) FORMS TO BE USED

In order that there may be a uniform understanding in respect to A. R. A. billing, the following information and explanations have been drawn up to supplement the A. R. A. Code of Rules. A clear understanding is necessary in order to protect the company in obtaining full compensation for its repairs to foreign equipment.

The following forms are used:

661-A—Original record of repairs.

661-C—Original record of wheels and axles removed and applied.

617 —A. R. A. Billing Repair Card, being the form used for billing owners for cost of work shown on 661A's and 661C's.

617½—A. R. A. wheel and axle statement, being a supporting voucher accompanying 617's, and giving detailed information shown on 661C.

619 —A. R. A. Joint Evidence Card, described in Section 9, which is used as the basis for rendition of bills.

620 —A. R. A. Defect Card, described in Section 9, also used as the basis for rendering bills against owners of cars concerned.

Sub-Para. (II) 661A—ORIGINAL RECORD OF REPAIRS

661A's are to be made out at all points where repairs are made and are to be filled in *at the car* by the person assigned or delegated to do this work, and will show repairs made to all system freight cars, including cabooses, and all foreign freight cars and foreign passenger cars. When men are sent out on the road to make repairs, form will be filled in and turned in at home station.

Not more than one car is to be recorded on this card for cars on repair track, but a separate card may be used for air brake work performed by air brake men on repair tracks at such points where it is not practicable to record this work on the card for other repairs. For repairs made in train yards, record of repairs of more than one car must be placed on a form. One line to be left blank between record for each car as indicated below:

P. C. C. & St. L. 564328	Box	Load	
A—1 new A. R. A. Std. Air Hose			Porous
C. M. & St. P. 73824	Box	Load	
L-3—1 11/8" Oil Box Nut			Missing
Mich. Central 47832	Gond.	Load	
R-1 1 new 9" Solid Brass			Worn out
Un. Pac. 63534	Box*	Empty	
R-2—1 new R. E. Brake Shoe			Broken

On repair tracks this form must be filled out to show each item of repairs to be made as far as possible in advance of the work being done, and after car is repaired the foreman in charge or inspector assigned to such work will check the work performed to see that the items listed have been renewed or repaired and any other work not listed will be added, and such work which has not been performed and which was already shown on this form at the time inspection was made, is to be crossed off.

It is necessary to show under heading "why made" reason for making repairs to each item. This will be shown as broken, worn out, missing, leaky, in fact whatever the defect may be. The information must not be assumed but is to be determined by actual inspection. When the terms such as broken, bent, missing, etc., are used and the defects have been caused by derailment, cornering, side-swiping, or other unfair usage or causes shown in A. R. A. Rule 32, this additional information must be shown. If repairs to car are made per authority of car owner as in the case of a car worn out and handled under A. R. A. Rule 120, the record must specify that repairs are made per car owner's authority, quoting letter authorizing the repairs. If repairs are made on authority of defect card, the record must so specify. Defect card is to be attached to card when sent into office for billing. This applies equally to system and foreign cars.

When material ordered from car owner on Form CD-10 is applied, the Form 661-A should show that material was furnished by owners.

It will be necessary to fill out Form 661-A for each car on repair track whether repairs are made or not. In the case of car on repair track and no repairs being made, the record must bear notation, stating that no repairs were made, and reason why car was on repair track.

Supervisor in charge of the work will sign the card as party authorizing repairs, and supervisor or inspector checking repairs and completing the

record will sign card as party making and checking repairs. Repair men in train yards will sign in both spaces.

When sending men out on road to make repairs to cars set out, the record card, Form 661-A, must be filled out to show repairs made and station at which repaired, and such record to be delivered to office at home station.

Initials and names of owners will be shown on repair cards in accordance with the following:

In the case of private companies, the name on the 661A *is to be shown in full*, but in the case of railroads the ordinary initials used to indicate the railroad concerned will be used, with the following exceptions:

How name of railroad is to be indicated
on 661A

Name of Railroad	How name of railroad is to be indicated on 661A
Algoma Eastern	Algoma East.
Arizona Eastern	Ariz. East.
Atlantic Coast Line	Atlan. Coast Line
Baltimore and Ohio Chicago Terminal	B. & O. C. T.
Baltimore and Ohio	B. & O.
Bangor and Aroostook	Ban. & Aroos.
Boston and Albany	Bos. & Alb.
Buffalo, Rochester & Pittsburg	B. R. & P.
Butte, Anaconda & Pacific	B. A. & P.
Canadian Southern	Can. Sou.
Colorado Northern	Col. Nor.
Cincinnati Northern	Cin. Nor.
Canadian National	Can. Nat.
Canadian Northern Ontario	Can. Nor. Ont.
Canadian Northern Quebec	Can. Nor. Que.
Canadian Pacific	Can. Pac.
Central Pacific	Cent. Pac.
Chicago & Illinois Western	Chgo. & Ill. West.
Chicago & Illinois Midland	Chgo. & Ill. Mid.
Cincinnati, Indianapolis & Western	Cin., Ind. & West.
Chicago, Memphis & Gulf	Chgo., Memphis & Gulf.
Chicago, Milwaukee & Gary	Chgo., Milw. & Gary
Chesapeake and Ohio	Ches. & Ohio
Chicago and Alton	Chgo. and Alton
Chicago, Indiana & Southern	Chgo., Ind. & So.
Chicago, Indianapolis & Louisville	Chgo., Ind. & Louis
Chicago, Rock Island & Pacific	C. R. I. & Pac.
Illinois Central	Ill. Cent.
Iowa Central	Ia. Cent.
Louisiana Western	La. West.
Louisville & Wadley	Louis. & Wad.
Mexican Central	Mex. Central
Maine Central	Me. Cent.
Michigan Central	Mich. Cent.

Mississippi Central
 Maryland & Pennsylvania
 Missouri Pacific
 Missouri, Kansas & Texas
 Missouri, Kansas & Texas of Texas
 New York, Chicago & St. Louis
 New York Central
 Nashville, Chattanooga & St. Louis
 Northern Pacific R. R.
 Spokane & International
 Southern Indiana
 Southern Pacific
 Temiskaming & Northern Ontario
 Texas & New Orleans
 Union Pacific R. R.
 Union R. R.
 Union Ry.
 Vandalia
 Virginian

Miss. Cent.
 Maryland & Penn.
 Mo. Pac.
 M. K. & T.
 M. K. & T. of Texas
 N. Y., Chgo. & St. L.
 N. Y. C.
 Nash., Chatt. & St. L.
 Nor. P.
 Spokane & Int.
 So. Ind.
 So. Pac.
 Temisk. & Nor. Ont.
 Tex. & N. O.
 Un. Pac.
 Union R. R.
 Union Railway
 Van.
 Virginian

In the case of cars with markings other than those listed under Railway Companies, or Private Car Companies, the information to be shown on the 661-A's will, in all cases, include the initials and number in full as on the car; the name and address of owners or lessees, if shown—otherwise number, time and date of trains cars arrived and departed by.

In writing up cards, the following abbreviations may be used:

Bro.—for broken.
 Miss.—for missing.
 W. O.—for worn out.
 Lky.—for leaky.
 Cut Jrl.—for cut journal.

Show in the space provided, whether loaded or empty. If load had to be removed or partly moved to make repairs, record must bear notation "R. & R. to make repairs," and also if load moved on "A" or "B" end or "A. & B." end. It should be understood that where the load of a car has shifted, such as a load of lumber, pipe, etc., and it is necessary to shift it back so as to provide proper clearance, no charge is to be made for such work, except if necessary to further move load from original position to make repairs, in which case record should show load "R. & R. to make repairs." Charge for R. & R. of load is proper, whether load is removed and replaced, or only partly removed or moved.

In quoting number of a car repaired, the greatest care must be exercised. Thousands of dollars are lost annually on account of inability to trace cars, due to clerical errors in writing down numbers.

In every case a check of each individual car number must be made. This can be done by the track list being made by one person, and 661-C's by a second, and the check made against one another. Or a second person can go over the original record of repair cards, and see that numbers are

correct. When neither method is feasible, the person writing a car number down should, when he reaches the next car, and has taken the number, look back and confirm his previously written down number.

**Sub-Para. (III) 661-C—ORIGINAL RECORD OF
WHEELS AND AXLES REMOVED
AND APPLIED**

At all points making repairs this form is to be filled out (one copy only) by either the person responsible for the removal or application of any wheels, or the inspector actually doing the work. The greatest care is necessary in writing down the complete information called for, *and paragraphs 9 and 10 of Section I must be most carefully followed.* The reason for removal of wheels will be set down in accordance with the list of defects shown in sub-para. (xx) of para. 9, Section I, and will in all cases constitute owners defects, with the exception of slid-flat wheels, or defects caused by fire or wreck. Slid-flat wheels must not be confused with "flat spots" such as described under shelled out wheels (sub-para. ix) and worn through chill (sub-para. xi) of Para. 9, Section I.

In changing rolled steel, or steel tired wheels, the amount of service metal will be *the distance from the witness groove* (see Sub-Para. xix of Para. 9, Section I) *to the edge of tread at narrowest area, less 1/4"*. If this measurement of service metal is more than 1 1/2", charge or credit must be made on the basis of 1 1/2", which is the maximum provided under A. R. A. rules. In the case of wheels removed the amount of service metal *before turning* will be arrived at by measuring as laid down in Section 4, Para. 2, Sub-Para. xiii. The amount of service metal *after turning* will be the distance above witness groove, less 1/4", measured *after the wheel has been turned down* again. Therefore this cannot be put on the 661-C by outside points until after the wheel has gone to the shops. Outside points removing steel wheels will ship them quickly and take up by correspondence in order to get the information to complete the 661-C's, and at shop points the wheels will be handled with the machine shop quickly so as to permit of completion of 661-C's.

Wheels removed which have to go to the machine shop for tire turning, will be shown on 661-C as *not* having standard full flange contour (put information under "Cause of Removal" column on old forms). Wheels removed for axle defects, which are not worn down so as to need turning, will show on 661-C as having standard full flange contour, and information shown as above.

Wheels applied either new or as received from machine shop (turned down) will be shown on 661-C as having standard full flange contour (put information under "Wheel No. Date Cast" column on old forms). Wheels applied with contour worn down will show as not having standard full flange contour, information being shown as above, but only in very isolated instances wheels will be applied to foreign equipment other than with new or restored standard full flange contour.

Under the heading "location," the box numbers are to be shown as per A. R. A. rule 14.

Under the heading "size and kind of wheels," it is necessary to show the information called for; for instance, 33" cast iron, 33" cast steel, 33" rolled steel, as the case may be.

Information as to length and diameter of journal, diameter of wheel seat, diameter of axle center, must be properly shown under the various headings, and the actual dimensions of axles removed, as well as those applied, must positively be shown. The dimensions laid down, method of calipering, etc., in Para. 10 of Section I must be carefully followed.

In order to permit of making proper labor charge for wheel changes, it is necessary that the type of truck be shown on the record. Present Form 661-C does not call for this information, but the blank space in the lower right hand corner on the form should be used for this purpose, and new forms which will be printed will call for the information. In showing information as to type of truck it is necessary to specify whether arch bar, Bettendorf, Scullin, Andrews, or whatever type of truck it may be.

The record is to be filed with Form 661-A covering repairs to same car.

When wheels are removed from tank cars belonging to L. G. Gillespie & Sons (lettered LOGX)—which operate principally between Tacoma and Chicago over our line—record will be made in the ordinary way, but in addition it will be necessary to hold the wheels for inspection. Standard markings as laid down in Sub-Para. xx, Para. 8 of Section I will serve to identify the wheels, but in addition M. C. B. office is to be advised by letter as soon as any of the wheels in question are removed, giving car number, which wheels removed, and cause for removal. M. C. B. office will notify owners to have inspection made and authorize bill being rendered against them, pending which bill will be held at point where wheels were removed.

Sub-Para. (IV) 617—A. R. A. BILLING REPAIR CARD

This form will be made out at designated points, and is to be in duplicate unless otherwise specified herein:

The original is to be forwarded to the master car builder's office at Milwaukee for billing purposes and the carbon copy retained at the local point where issued and filed with Form 661-A. One or more of these forms must be filled out for every foreign car repaired. In filling out this form, it is necessary that care be taken to show all the information called for under the various headings.

The party writing up the repair cards must show the information just as shown on the record card, Form 661-A, and if the Form 661-A does not contain all necessary information as called for in the A. R. A. Rules, such as new or second-hand material, where required, proper location,

kind of material, etc., the record card must be returned to the foreman for further information before the billing card is written up. When writing up repair cards it will not be permitted to assume any information as to why made, etc., and under no consideration should any corrections be made on the record card, Form 661-A, excepting by the person or persons who have vouched for the correctness of the original record by their signatures.

If repairs have been made on authority of a defect card, which has been issued by a road other than the owner, the billing repair card 617, must be issued in triplicate and the original and one copy attached to the defect card and forwarded to the master car builder's office at Milwaukee. In such case the Form 617 must be marked "account defect card" opposite such items as are covered by defect card. If repairs made to a car are covered by defect card issued by owner of such car, then it is only necessary to attach one copy (the original) of billing repair card to defect card.

At repair points where clerks are employed in writing up the repair cards, the number of board feet of lumber must be shown in proper column opposite each item of repairs. However, where clerks are not employed, this information need not be shown, as the calculation will be made in the master car builder's office. It is very necessary that Form 661-A show the *finished* size of lumber used, and this information be correctly transcribed to Form 617.

Repair cards issued for repairs made for which car owner is not responsible must be filled in and numbered same as if car owner was responsible, excepting that such repair card is to bear the notation "no bill" and it will not be necessary to show weight of material, board feet of lumber nor labor. Such cards must be forwarded to the master car builder's office along with all other billing repair cards.

When wrong repairs are corrected and there is a joint evidence card, Form 619, covering such wrong repairs, a billing repair card, Form 617 (or 617½ if wheels are changed) must be issued for system cars, and same attached to the joint evidence card and forwarded to the master car builder's office. Such repair card should bear the notation "account joint evidence card."

When material ordered from owners on Form CD-10 is applied, the billing repair card, Form 617, should indicate that material was furnished by owners. (This information must show on the record card, Form 661-A.)

When Forms 975 are turned in by trainmen at the terminals and checked over by the car foreman, and it is found that repairs have been made by the trainmen, a billing repair card, Form 617, is to be issued for such repairs when made to foreign cars and the copy of the repair card, Form 617, is to be attached to the Form 975 and filed in same case with the record cards, Form 661-A.

(In order to keep the file containing the 975 reports complete, a copy

of the original 975 report will be made to be filed with the other 975 reports; however, the original 975 report must be filed with the billing repair card.)

**Sub-Para. (V) 617 ½—A. R. A. BILLING REPAIR
CARD FOR WHEELS AND AXLES**

This card will be made out at all points where Forms 617 are filled out. The card will show the same information as the 661-C, including that pertaining to type of truck and whether rolled steel or steel tired wheels applied or removed have standard full flange contour or not.

The form in question (617½) is merely a supporting voucher to accompany the bill against owners for repairs, but must be very carefully handled in order that check may be made and bill passed for payment without delay.

**Sub-Para. (VI) 619—A. R. A. JOINT EVIDENCE
CARD**

This form is not a direct billing form, but is used as the basis for rendering bills against delivering lines. It is fully described in Section 9, and is referred to here in connection with its use for billing purposes.

When the wrong repairs have been corrected at the interchange point and Form 661-A or 661-C has been made up to cover all repairs to the car, a billing repair card will be issued to cover the wrong repairs corrected and attached to the joint evidence card and forwarded to the master car builder's office.

Sub-Para. (VII) 620—A. R. A. DEFECT CARD

This card is an inspection form, and is fully described in Section 9, but as it is used as the basis for rendering bills against car owners or delivering line, its use in this regard is referred to herein.

When wrong repairs are corrected Form 661-A or 661-C will be made out, and bill rendered against the road responsible for the wrong repairs.

**Sub-Para. (VIII) BILLS FOR REPAIRS TO PRIVATE
OWNED CARS**

Repairs to such cars must be recorded on Form 661-A or 661-C and billing repair card, Form 617 or 617½, issued, same as in case of any other foreign car except that billing repair card is to be issued in triplicate, one copy to be filed with the Form 661-A and one copy to be attached to bill.

The car foreman will prepare a statement showing the cost of repairs, using M. C. B. prices for material and actual number of hours at M. C. B. rate per hour, and add 25 per cent to the total of the bill to cover overhead expense. After statement has been prepared and one copy of the billing repair card attached thereto, it is to be turned over to the local agent for collection.

The original repair card must in all cases be forwarded to the master car builder's office at Milwaukee with notation "copy and bill delivered to

agent for collection.” When such repair cards are received in the master car builder’s office, it will take up with the local agent to ascertain whether bill was actually collected. The car foreman when delivering the bill to the agent must advise him that bill should be collected before the car leaves the station, or if impossible to get bill ready in time to make the collection, the agent is to wire the next stopping point to arrange for collection and in no case must cars be delivered to another road before bill has been collected.

**Sub-Para. (IX) BILLS FOR THROUGH LINE
SERVICE**

Where through line service is established, the expense will be handled per M. C. B. Rule 9 of the Passenger Car Rules, and per instructions issued by Master Car Builder covering such service.

Sub-Para. (X) SYSTEM OF FILING VARIOUS FORMS

When cars have been repaired and record has been completed and properly signed; it is to be delivered to the car foreman’s office. At large terminals where there are several yards, this record must be collected and taken to the car foreman’s office by some designated person.

The cards are to be filed in cases containing one hundred spaces, each space to be numbered, the numbers to be from 00 to 99, inclusive, and the case to be constructed and numbered per blue print, available upon application. Cards will be filed in datal order in accordance with the last two figures of car numbers. For instance, car 26578 is to be filed in space No. 78.

The record for repairs in train yards will be filed in separate cases, which will contain 12 compartments and will be constructed and lettered as per blue print. These records must be filed in date order in the compartment for each month.

Cards in the 100 space cases or in the 12 compartment cases must be kept in date order, the last date to be on top. Before cards covering repairs to foreign cars are filed, the repair cards, Form 617 and 617½ will be written up and carbon copy filed with the record.

At the small points where three or less men are employed, the record cards covering repairs to one car will be filed in the case containing 12 spaces in same manner as record cards covering repairs in train yards and covering more than one car.

Separate instructions will be issued to district general car foremen as to what points are to be supplied with standard 100 space cases and 12 compartment cases, also what points will be supplied only with 12 compartment cases.

Forms 661-C, 617 and 617½ are to be attached to the 661-A concerned, and filed as above described.

Forms 617 are to be numbered at each repair point where issued commencing with No. 1 as the first of each year and numbered consecu-

tively throughout the year. When it requires more than one repair card to show repairs made to one car, the first card is to be numbered and a sub-number is to be shown indicating the number of cards issued for each car.

In case of wheel changes which are shown on Form 617½, the latter form is to be counted as one of the cards for the car; for instance, if two repair cards, Form 617, and one wheel record repair card, Form 617½, are issued, all of the forms 617 and 617½ will be numbered and sub-number shown, for example, "572-3 cards," the number "572" indicating the number of the repair cards covering one car and the "3 cards" indicating the number of repair cards covering repairs made to such car. These numbers are to be written in the upper right hand corner in all cases. In this case each of the three repair cards would bear the reference "572-3 cards."

The object of numbering cards in this manner is to insure all repair cards for one car being kept together. It is possible when repair cards are sent to the master car builder's office, for them to become detached and the billing office will know from the number reference on any of the cards if any of them are missing and can then locate them.

Sub-Para. (XI)

TRACK LIST

A record must be kept of all cars received on repair tracks and this record will show the date the cars are received, the date repaired and the date pulled off repair track; also at points where there is more than one repair track, the record should show the repair track number for each car. This record is to be kept in book known as Form 302 and each page in the book is to be ruled and headed as shown below:

Ini- tials	Car No.	Date Received	Date Repaired	Date Pulled	Track No.	Class of Repairs	Check of Record 661-A
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This record is to be taken daily except at large points where same tracks are not pulled daily in which case it will only be necessary to take record of the cars when the tracks have been pulled, but record should be made complete for each day by referring to date record was last taken for cars on tracks not pulled so that the bad order reports, Form 55, can also be taken from this record.

This book is to be kept on the desk of the clerk writing the repair cards, Form 617, and the clerk will make a check of all the cars repaired, and see that a record of repairs on Form 661-A is received for each car on repair track. So that the track list will show that it has been checked to see that a Form 661-A is received for each car on the repair track, the clerk will make a check mark opposite each car in the column headed "Check of Record 661-A," and will use a red or blue checking pencil for this purpose. If the track list shows that a car has been repaired and the clerk has not received a Form 661-A to cover such car, he will immediately take up with the foreman and see that such form is furnished whether car was repaired or not, and if not repaired, record must bear

notation as to why no repairs made. This is very important and must be followed closely by the clerk.

Para. 3 ITEMS TO BE BILLED FOR

Sub-Para. (I) GENERAL

A. R. A. Code of Rules, revised from time to time, will be used as the basis for deciding what is to be billed for. Information set out below must be shown in connection with the various items concerned.

Sub-Para. (II) AIR HOSE

See A. R. A. Rule 9: Second-hand air hose is not to be used in making repairs to foreign cars; however, if applied account new hose not being on hand, the record is to show that second-hand hose was applied.

When applying air hose no special mention is to be made of gasket in same hose as the price covers hose complete.

Sub-Para. (III) BOLTS, NUTS AND WASHERS

The number and size of bolts and purpose for which used must be shown; for instance, in the case of draft timber bolts, show "one draft timber bolt 7/8"x18".

Nuts individually applied must be specified as to size and location, and in the case of oil box nuts, the box number must be shown as per A. R. A. Rule 14. (This is not to be construed as meaning nuts applied to bolts which are renewed.)

When washers are applied, the number and size and location must be shown.

Sub-Para. (IV) BRAKES

Brake Beams Complete: See A. R. A. Rule 9 and in addition to information called for show if equipped with finger guards (if not so equipped no mention need be made), also show name of part defective on beam removed. Also show location per Rule 14; that is, show box number, same as for wheels and axles, brasses, etc.

Brake Connecting Pins: When brake pins are applied show number of connecting pins renewed or removed and replaced in connection with lever for brake beam applied, also if other connecting pins are renewed show name of part of brake rigging, in which such pins are located, as per example shown below:

Example

End	Repairs Made	Material		Why Made
		Size or Weight	Kind	
R. & L. 2	1 new Ajax A. R. A. No. 2 brake beam (with finger guards)			Cresco A. R. A. No. 1 Brake Head Broken
	2 connection pins R. & R. in brake lever, same beam . . .			Account repairs
	1 connection pin 1 1/8"x3 1/2" brake lever, same beam . . .	1		Missing
	1 connection pin 1 1/8"x3 1/2" opposite end of bottom rod	1		Worn out
	1 connection pin 1 1/8"x3 1/2" opposite end of top rod . . .	1		Worn out
	5 connection spring cotters . .			Missing

Brake Rods, Levers and Other Connections: When showing these items indicate number of brake connecting pins removed and replaced in addition to number of new pins applied. This information to insure proper labor charges being made.

Brake Beams Repairs: If same brake beam which is removed is repaired and replaced on same car it is necessary to show brake beam removed, repaired and replaced, giving make and type and number of beam indicating parts defective. This record should show notation "same beam R. R. & R."

Brake Beam Hangers: See A. R. A. Rule 9, and in addition show location per Rule 14, that is, give the box number same as you would for wheels, brasses, etc. Also bear in mind that second-hand brake shoes must not be used for repairs to foreign cars as no charge can be made, and if second-hand shoes are used account new material not being available, record must show second-hand shoe applied.

Air Brakes Cleaned: Show cylinder and triple valve applied and cleaned per A. R. A. Rule 60. Show name of road and date of last previous cleaning, also make and type of triple valve removed. It should be understood that in the cleaning of air brakes the triple valve applied must have passed over the A. R. A. standard test rack and, therefore, the record must show that the air brake work was performed per Rule 60.

In order to justify charge, the triple valve and cylinder must be cleaned at the same time, also retaining valve and dirt collector should be cleaned at the same time, for which additional charge will be made.

When car is stencilled to show type of triple valve standard thereto, the stencilling must be followed in applying triple valve regardless of type of valve removed. In this case indicate on record card how car is stencilled. When car is not stencilled to show type of valve standard, then the same type of valve is to be applied as that removed.

Sub-Para. (V)

BRASSES

See A. R. A. Rule 9. Pattern number must not be used, but, as provided for in Rule 9, the length of brass should be shown. Second-hand brasses are not to be used in repairing foreign cars; however, if account of new brasses not being available and it being necessary to apply second-hand brasses, the record should show same as second-hand. It should also be understood that brasses which have been relined will be considered as new material, and shown on record as new brass.

Sub-Para. (VI)

COUPLERS AND PARTS

See A. R. A. Rule 9, for information required, and in addition it will be necessary to show the size of butt.

Sub-Para. (VII)

METAL PARTS REPAIRED

On Anvil—Metal parts removed for straightening or welding on anvil, or threading, any or all, it is necessary to show weight of each item and R. R. & R. This per A. R. A. Rule 107, Item 421-A.

Sub-Para. (VIII) PACKING LEATHERS

In view of the use of second-hand and reclaimed packing leathers not being permitted on foreign cars, it is necessary to indicate when applying a packing leather, whether new or second-hand, or reclaimed material is used. New material must be used to justify a charge, also be sure to show whether 8 inch or 10 inch packing leather is applied.

Care should be taken when cleaning air brakes to show on record card the following items when renewed, as additional charge is permissible per Rule 111, Item No. 29:

Packing Leathers;
Cylinder Non-Pressure Heads;
Cylinder Pistons;
Triple Valve Bodies;
Cylinder Bodies;
Cylinder Pressure Heads.

Sub-Para. (IX) PIPE WORK AND CONNECTIONS

Pipe 12 inches or less in length is to be referred to as a nipple and it is necessary to show diameter and length of such nipple. The price for nipple includes cost of threading, therefore, no mention is to be made of threads cut on a nipple.

Pipe longer than 12 inches is not to be referred to as a nipple but must be referred to as pipe and the diameter and length should be shown, and in addition show two threads cut for each such length of pipe.

Sub-Para. (X) RENAILING ROOFING AND SIDING

See A. R. A. Rule 107, Item 258. To insure proper labor charge being made it is necessary to show on the record card the number of stringer feet of siding or roofing renailed and to determine the number of stringer feet, it will be necessary to take into consideration the renailing of siding at the sill, belt rail and plate. For illustration, if siding is renailed at sill for a distance of two feet, at one belt rail for distance of one foot, and at plate for distance of two feet this work would be shown on record as follows: "B. R.—Siding renailed 5 stringer ft. account loose."

In the case of roofing renailed the method of determining the number of stringer feet would be followed, figuring the number of feet renailed at plate, ridge pole and purlines and showing the total number of stringer feet.

In the case of siding or roofing renailed, be sure to show on record card, the number of pounds of nails used.

**Sub-Para. (XI) REWEIGHING AND REMARKING
CARS**

See A. R. A. Rule 30, and make record on Form 661-A of all foreign cars reweighed and remarked, or add this information on Form 661-A, covering repairs made to same car. Show old and new weight, and date car was previously reweighed, or if no old date, so indicate.

Sub-Para. (XII)**RODS**

Tie Rods. When necessary to apply rods to open top cars which have the sides spread or bulged beyond clearance limits, record must indicate that tie rods were applied, giving dimensions of same and reason for applying.

Truss Rods. When tightening body truss rods, the term "trussed car" must not be used. The record must show the number of body truss rods tightened. It is also necessary to specify whether or not jack is used when tightening rods, indicating by showing on record card, "car jacked" or "car not jacked."

The record should also show if turnbuckle and one or two nuts or one connection pin or bolt were R. & R. account repairs to one section or rods complete.

Sub-Para. (XIII)**ROOFING**

When renewing roof boards no reference is to be made as to single or double roof, merely show the number of roof boards, and the dimensions of same. The billing clerk when making up the repair card will calculate the lineal feet of roofing to arrive at the proper labor charge.

Sub-Para. (XIV)**RUNNING BOARDS**

Permanent. When necessary to secure old running boards account loose, the record will show the number of screws applied. It is not necessary to show the lineal feet of running board in this case. When running boards are renewed the record must show whether longitudinal or latitudinal, and if latitudinal, record must show if same are fastened with bolts or screws.

Sub-Para. (XV) SPRING COTTERS OR SPLIT KEYS

It should be understood that spring cotters or split keys must be shown on record card whether applied separately or in connection with other repairs.

Sub-Para. (XVI)**SUBSTITUTION OF MATERIAL**

See A. R. A. Rule 17. Malleable iron, wrought iron, or cast steel A. R. A. standard material may be substituted for each other or for gray iron A. R. A. standard. Gray iron A. R. A. standard material should not be substituted for malleable iron, wrought iron or cast steel A. R. A. standard, but if necessary to make such substitution account not having proper material, the record should show kind and weight of material applied and kind and weight of material removed.

Sub-Para. (XVII)**TRUCK SPRINGS**

Location to be shown for all truck springs applied as follows:

Truck springs applied at left side, "B" end, should be shown "B. L.," and if at right side, "A" end, should be shown "A. R."

When renewing or replacing truck springs it is necessary to show the number of springs applied or replaced on each end, showing the location as indicated above.

The weights for truck springs must be charged in accordance with the following table:

Class	Capacity Truck	Style Truck	No. of Coils	Size Outside	Size Inside	Weight Outside	Weight Inside
A	60,000 lbs.	AB	4 double	5 $\frac{3}{8}$ x 6 $\frac{5}{8}$ "	3 $\frac{1}{4}$ x 6 $\frac{1}{2}$ "	14 lbs. 12 oz.	5 lbs. 6 oz.
B	70,000 lbs.	AB	4 single	5 $\frac{7}{16}$ x 8 $\frac{1}{4}$ "	.....	22 lbs. 5 oz.	.....
C	80,000 lbs.		{ 2 single } { 2 double }	5 $\frac{7}{16}$ x 8 $\frac{1}{4}$ "	2 $\frac{7}{8}$ x 8 $\frac{1}{4}$ "	23 lbs. 0 oz.	6 lbs. 7 oz.
D	100,000 lbs.	AB	4 double	5 $\frac{7}{16}$ x 8 $\frac{1}{4}$ "	2 $\frac{7}{8}$ x 8 $\frac{1}{4}$ "	23 lbs. 0 oz.	6 lbs. 7 oz.
E	60,000 lbs.	Ped	1 double	7 x 7 $\frac{1}{8}$ "	4 $\frac{1}{8}$ x 6 $\frac{13}{16}$ "	28 lbs. 8 oz.	10 lbs. 8 oz.
F	80,000 lbs.	Ped	1 double	8 x 7 $\frac{3}{4}$ "	4 $\frac{7}{8}$ x 7 $\frac{3}{4}$ "	38 lbs. 6 oz.	14 lbs. 6 oz.
G	100,000 lbs.	Ped	1 double	8 x 7 $\frac{7}{8}$ "	4 $\frac{5}{8}$ x 7 $\frac{1}{2}$ "	40 lbs. 5 oz.	14 lbs. 8 oz.
H	140,000 lbs.	{ Side } { Frame }	5 double	5 $\frac{7}{16}$ x 8 $\frac{1}{4}$ "	2 $\frac{7}{8}$ x 8 $\frac{1}{4}$ "	23 lbs. 0 oz.	6 lbs. 7 oz.

If it is necessary to jack car to renew spring, record must show "car jacked."

Sub-Para. (XVIII)

WELDING

For oxy-acetylene and electric welding actual number of hours for welders and actual number of hours for helpers. Material used will be shown as one item, no details being necessary, as for instance "welding material \$1.50." In order to arrive at this, the average figure of 75 cents per hour will be used—in other words, where a welder and helper worked one hour on a job repair card would show "welding material \$1.50." These material charges include gas, oxygen and welding material.

If parts are removed from car for welding, record must show parts R. R. & R., and any other operations necessary.

Sub-Para. (XIX)

WHEELS AND AXLES

Show number of pairs of wheels and axles applied, also whether new or second-hand, and show defects in "why made" column, also show location as per A. R. A. Rule 14 and type of truck; all other information to be shown on Form 661-C, as per instructions covering use of that form.

Para. 4

ITEMS NOT TO BE BILLED FOR

Sub-Para. (I)

JOURNAL BOXES REPACKED

There is no charge for journal boxes repacked, but the information must be shown on original record of repairs nevertheless, and will state number of boxes repacked. A. R. A. Rules 9 and 66 govern, and in cases of new cars not stencilled to show when repacked, date car built will govern.

Sub-Para. (II)

MATERIAL NOT TO BE APPLIED TO CARS

The following material cannot be billed for and *is not to be applied to cars*:—

Malleable iron couplers.

Open knuckles.

Malleable or steel back journal bearings.

Plain cast iron brake shoes (not having reinforced back).

Second-hand air hose, brake shoes and journal bearings.

Sub-Para. (III)**TEMPORARY REPAIRS**

The following repairs are considered temporary repairs for which no bill can be rendered whether due to owner's defects or not and should not be confused with wrong repairs:

1. Wood instead of Metal Queen Posts.
2. Wood instead of Metal Side Bearings.
3. Wood instead of Metal Body Bolster Truss Rod Saddles.
4. Wood instead of Metal Oil Box Lids.
5. Wood Block instead of Complete Friction Draft Gear.
6. Pocket Bolts in place of Pocket Rivets. It should, however, be understood that repairs are chargeable if bolts are applied in place of bolts.
7. When old timbers are applied above floor account broken sills in order to make cars safe to haul to repair point or send home.

Sub-Para. (IV)**WRONG REPAIRS**

If *not* owners defects, bill cannot be rendered for wrong repairs. In substituting material other than standard to the car, such as wooden draft timbers in place of metal draft arms, or single spring or tandem spring draft gear, the record must show work done and in column "why made" the parts removed credit to be allowed must be shown.

It must be understood however that repairs of this kind are chargeable to owners if due to owner's defects.

Sub-Para. (V)**MARKING CARD FOR REPAIRS NOT
BILLABLE**

For repairs not billable, the record in addition to showing why repairs were made, should show "No Bill" for such items only and the "No Bill" items shown separate from other billable items.

SECTION XI

REQUISITIONING FOR MATERIAL

Para. 1 GENERAL PURPOSE

A requisition is an order for material. There are several different forms for ordering material, the use of the proper form depending upon the kind of material ordered and whether it is for stock, A. F. E. work, or for immediate use. Some requisitions, such as Form 1962, Stock Transfer Requisition, and Form 130, A. F. E. Requisition, are used only to obtain material; others, such as Form 189, Hand to Bearer Order, Form 61, Stationery Requisition, and Form 1727, are used not only to obtain material but also to charge it out on.

Requisitions should be carefully made and describe correctly the material that is wanted. Nick names and shop names of articles should not be used. Where articles have piece or pattern numbers or blue print or catalogue reference, such information should be shown on the requisition, so as to enable the store department to furnish the material desired without any question. All the information called for on the requisition blanks should be furnished. Requisitions should be signed personally by the foreman ordering the material and be forwarded to his superior officer for approval or direct to the storekeeper as may be covered by instructions.

Para. 2 REQUISITIONS FOR ORDINARY MATERIAL

Store department divides its material into four general classifications, as follows:

- (a) Material for maintenance of ways and structures.
- (b) Material for maintenance of equipment.
- (c) Material for conducting transportation.
- (d) Material common to all departments.

The items maintained under these various classifications are as follows:

- (a) *Maintenance of Way and Structures.*

Class No.

- 1—A Frogs, switches, and crossings, and parts of same.
- 1—B Track fastenings, track bolts, spikes, etc.
- 1—C Track tools—all kinds, including hand and push cars, gasoline motor cars, velocipedes, and parts of same, and miscellaneous track material.
- 2—A Interlocking and signal material.

- 2—B Telegraph and telephone material.
- 3 Building and paving brick, cement, lime, stone, cast iron water and culvert pipe, roofing tile and slate, prepared roofing, all kinds, for buildings, sewer and drain tile, etc.
- 4 Lumber, bridge and building, including piling, bridge timber, bridge ties, fence posts, shingles, and manufactured lumber for bridges and buildings.
- 5—A Switch ties, treated or untreated.
- 5—B Cross ties, treated or untreated.
- 6 Iron bridges, turntables, and structural steel, all kinds.
- 7 Ballast, all kinds, including riprap.
- 8 Rail, all kinds, except scrap.
- 9—A Fuel and water station material, and scales, and parts.
- 9—B Elevators, and coal and ore handling and conveying machinery.
- 9—C Steam derricks, steam shovels, steam ditchers, pile drivers and other such portable equipment used in roadway work and special material for same.
- 10 Chemicals for timber treatment.
- (b) *Maintenance of Equipment.*
- 11 Bolts, nuts, washers, rivets, lag screws, pins and studs.
- 12 Springs, helical and elliptical, all kinds, for locomotives and cars.
- 13 Flues for locomotive and stationary boilers, arch tubes, dry pipes, all kinds.
- 14 Brass, copper, and steel tubing, copper ferrules, and soft metals, such as copper, babbitt, tin, lead, and zinc.
- 15 Bar iron and steel, spring steel, tool steel, shaped steel, sheet steel under No. 13 gauge, sheet copper, tin and brass, chain, all kinds, except light coil, wire netting.
- 16 Boiler, fire-box, tank and sheet steel, No. 13 gauge and heavier, all kinds.
- 17 Heavy forgings for locomotives, such as crank pins, piston rods, quadrants and levers, motion links, valve yokes, etc.
- 18 Car forgings, iron and steel for passenger and freight cars, including metal brake beams and metal bolsters.
- 19 Locomotive castings, including gray iron, malleable, and steel, rough and finished, also cylinders, rough and finished.
- 20 Car castings, including gray iron, malleable, and steel, all kinds, also couplers and knuckles, and parts for metal car roofs.
- 21 Rough and finished brass castings and journal bearings.
- 22 Air brake material, all kinds, for locomotives, passenger and freight cars, except hose, but including air pump and parts.
- 23 Mechanical appliances for locomotives, such as injectors, lubricators, bell ringers, sanders, pop valves, air and steam gauges, whistles, boiler checks and parts, water gauge and lubricator glasses, and speed recorders.
- 24 Passenger car trimmings, all kinds, including oil and gas lamps and fixtures, steam heat fixtures and fittings, except steam hose, mail car, coach and chair car seat fixtures, including upholstering material of all kinds, such as carpet, linoleum, rubber tiling and

- matting for cars and buildings.
- 25 Electric material for steam and electric locomotives.
- 26 Electric material for steam and traction line cars.
- 27 Shop fuel, smithing coal, coke, fuel oil for furnaces, gasoline, charcoal, etc.
- 28 Foundry supplies, fire brick, fire clay, etc.
- 29 Wheels, tires, and axles for locomotives and cars, including driving wheel centers, cast iron, steel tired and rolled steel wheels.
- 30 Lumber, locomotive and car, rough and finished, including manufactured articles.
- 31 Machinery and machine tools, including all power-driven shop machinery.
- 32 Locomotive boilers, fire boxes, locomotive tenders and frames.
- 33 Trucks for equipment, locomotives, and cars.
- 34 Material in process of manufacture.
- 35 Floating equipment material, all special material peculiar to floating equipment.
- (c) *Conducting Transportation.*
- 36 Locomotive, train and station supplies, including tinware, all kinds; lanterns, train, switch, and other signal lamps and parts; locomotive and caboose tool equipment, such as jacks, shovels, wrecking frogs, train chains, etc.; baggage and warehouse trucks, caboose and station stoves and parts, ticket cases, tool handles, and all kinds of woodenware.
- 37 Oil house material, all kinds, including lubricating oils and grease, illuminating oils, boiler compound, all kinds, and waste, all kinds.
- 38 Ice, sawdust, hay, and straw for ice houses.
- 39 Fuel, locomotive, including coal and wood and fuel oil for locomotive use only.
- 40 Fuel for stations and cars: includes coal, coke, and wood.
- 41—A Dining car, restaurant and boarding car supplies.
- 41—B News service supplies.
- (d) *General—Common to All Departments.*
- 42 Pipe, iron and steel, except boiler flues.
- 43 Pipe fittings, all kinds, for steam, air, and water; valves and cocks for same.
- 44 Electric lighting material and supplies for buildings and grounds.
- 45 Hardware, all kinds, including nails, jacks, small hand tools, emery wheels, wire, and wire cloth.
- 46 Rubber and leather goods, including air, steam, and water hose, packing, all kinds, including metallic packing, asbestos, rope, belting, pipe covering, and boiler lagging.
- 47 Glass, drugs, chemicals and painter's supplies, such as brushes, scrapers, sand and emery paper and cloth, also paints, oils, and varnishes, all kinds for equipment and buildings.
- 48 Stationery and printing.
- 49 Power plant equipment, including steam and electric power plants and generating stations, motors, and other electrical equipment for operating shop machinery.
- 50 Scrap, all kinds, including scrap rail.

All ordinary stock is maintained at designated points, and it is not necessary for foremen to make requisitions to replenish such stock, excepting at the minor repair points where there is no storekeeper. At such points, the foreman or inspector will make requisitions, using Form 1962, Stock Transfer Requisition, to obtain the required material. All information called for on the form should be shown on the requisition. Material carried in stock is divided into classes according to its use, and storekeepers who make requisitions on Form 1962 will confer with their division storekeepers and arrange to make their requisitions by classes on the dates desired by the storekeeper.

Whenever special material not usually carried in stock is required, Form 1727 should be used to order it. A requisition to cover special material wanted is necessary even at a point where there is a storekeeper, and it must not only be on this form, but it must be explained why it is needed, as the storekeeper has no authority to order material which is not regularly used in his territory.

When work of a special nature, such as schedule work is authorized, the foremen will order on Form 1727, thirty days in advance of the date on which he will begin work, the quantity of material that he requires specially to do this work for the next succeeding month, and each month thereafter will order what he requires for the second following month until the work has been completed.

[It should be understood that all material used in the repairs of freight cars, both system and foreign, is charged out through reports made by drawing off from the 661-A forms the various items of material used. It is, therefore, of the utmost importance that form 661-A show all material that was used. See Para. 2, Sub-Para. (ii) of Section X.

All material used for other purposes, such as repairs to buildings, machinery, etc., is charged out at the time that it is used, and it is necessary that either a form 189 or form 1727 be furnished at the time showing purpose for which it was used, so that proper charges can be made.]

Para. 3 REQUISITIONS FOR A. F. E. MATERIAL

Requisitions for A. F. E. Material which has to be purchased should be made in accordance with instructions issued by the general storekeeper. Special requisitions on Form 130 are required for A. F. E. material and can be made only in the master car builder's office. When necessary to order material for rolling stock or shop equipment covered by an A. F. E., a statement of the material required must be furnished to the Master Car Builder, who will arrange for the necessary A. F. E. requisition. This will be made in duplicate, both copies of which will be sent to the general storekeeper.

A. F. E. material which has not to be purchased complete, but is fabricated in our own shops, such as side and end sheathing straps, end belt rail bands, end plate bands, heavier corner bands, roof braces, etc.,

will be ordered by the foreman through the local storekeeper in the ordinary way.

Should emergency arise, making it necessary to order a small amount of material for A. F. E. work in addition to that already on A. F. E. requisition, and work will be seriously delayed if A. F. E. requisition is made according to instructions, it will be proper to order such small additional material on the local storekeeper, using form 1727 to obtain it.

Para. 4 REQUISITIONS FOR STATIONERY

All stationery should be ordered on Form 61. Requisitions should be made on the first of each month, and should cover all stationery that will be used during the next 30 days. Only one requisition should be made for each station in any one month. Items due on previous requisitions should not be reordered unless the quantities due are not sufficient to take care of the next thirty day's requirements. All requisitions for stationery on Lines East shall be sent to the master car builder's office at Milwaukee shops for approval. On Lines West, they shall be sent to the assistant master car builder at Tacoma for approval, who in turn will forward them to the Miles City Store to be filled.

**Para. 5 CREDITS FOR MATERIAL RETURNED
 TO STORE DEPARTMENT**

Material which has been charged out shall, when again returned to the store department, either as usable material or as scrap, be credited to the account to which it was originally charged, and be charged to the store department. Form 1728 shall be used for this purpose. Material returned to the store department shall be listed on this form, showing quantities returned and whether usable or scrap. Material removed account changes in standards, for which there will be no further use shall be listed as scrap. Form 1728 credits will be checked by the store department and if found correct will be approved and handled for necessary accounting. All credit requisitions shall be made at the time that material is turned over to the store department.

Credits for material recovered in connection with repairs of freight cars will be shown on form 661-A, from which recapitulation shall be made on form 1728 at the close of each month or shorter periods where necessary.

**Para. 6 MATERIAL SHORTAGE REPORTS
 (FORM 675)**

Whenever stations are actually holding cars for want of suitable material, no failure must obtain in the filling out and sending in of material shortage report, Form 675, copy going to the proper parties. These shortages, in all cases, must cover equipment being held for material for which requisition has already been placed. It is understood that the report must be sent in daily, except on such days when cars are not held, even though the situation is the same as on the previous day.

SECTION XII

STANDARD PRACTICES RECORDS

Para. 1 RECORD OF CARS WEIGHED

Sub-Para. (I) FREIGHT TRAIN CARS

It is necessary to reweigh freight equipment periodically, as laid down in Sub-Para. (iii), Para. 4 of Section 2. Whenever cars are so reweighed report must be made direct to the M. C. B. office on Form 749 (one copy only). These reports will be numbered consecutively, commencing at 1 for the first report each month. If cars are weighed on the last day of the month, and a report made out in consequence, in addition to being numbered it will be marked "Final." By this means a check can be maintained to insure that all reports have been received. When no weighing is done on the last working day of the month, a blank report will be made out, duly numbered, marked "Final" and forwarded to M. C. B. office in the usual way.

Sub-Para. (II) PASSENGER TRAIN CARS

Most of our passenger cars are shopped at Milwaukee, but many cars do not reach there for long periods, on account of requiring only light repairs which are taken care of at nearest shop point. As a result our records of weights of passenger equipment are not of recent enough date to use the figures for working up mechanical data. Whenever passenger cars reach shops for light repairs and repainting, they will be reweighed and reported on 749 report in the ordinary way. In weighing passenger cars the weight must be determined at both A and B end, and reported separately. To obtain weight correctly the trucks must be centered properly on the scales, and car must be free from other cars or from engine. The car should be weighed *after*, not before shopping.

Para. 2 REPORT OF LOADS TRANSFERRED

It is our practice to repair cars under load whenever practicable, as it has been found that by so doing freight claims are greatly reduced. Occasionally, however, loads must be transferred, and record must be kept of such transfers, and report made weekly direct to the superintendent of transportation, Chicago, on Form CD 21. Duplicate copy is to be sent to the M. C. B. office. (Read in conjunction with Sub-Para. (ii), Para. 4 of Section 2.)

Para. 3 SAVINGS REPORT

On a system so large as our own the opportunities for effecting savings are very great. It is our policy to have every point at which car men are employed keep this fact prominently before them and at the end of each month report through the correct channels to the district general car foreman any savings which have been effected by the installation of new

devices, new methods of handling material, reclamation of material, payroll savings, etc.

A great deal has been accomplished in our department in making savings along the lines indicated, but we have not been so successful in getting the facts in connection with such savings properly reported. The object of such reports, which are finally consolidated into one report for the whole department, is not to make a proper showing, but to have devices and methods inaugurated at other points, which can be arranged if reported, but failure to do so results in a loss of what should be something to the advantage of both the department and the railroad.

Reports should be made and sent in as quickly after the close of the month as possible.

SECTION XIII

RECORDS AND REPORTS ON FACILITIES

Para. 1 PERFORMANCES OF MACHINES

From time to time a record should be made of the performance of each machine in operation at a repair point. The information should be kept locally, in such form that it will be readily available, as it is likely to prove of great value when considering enlarging a point, alterations, or additions. In any case every foreman should know the capacity of each machine he has under his jurisdiction, and should be in a position to judge whether its output is such that the machine is being operated advantageously.

Para. 2 ADDITIONAL TOOLS AND EQUIPMENT REQUIRED

There should be on hand at every repair point a record—preferably in book form—of what additional tools are wanted to permit of output and economic operation. This does not mean merely stating a certain number of additional jacks, or some other item, but should have notes of the size and make, where and how to be used, and what advantages would be derived from their being provided, so that the matter may be discussed usefully on the spot when opportunity arises. With so large a system to take care of it is quite necessary that local foremen make their own case for the supply of small tools and minor machinery, and there is no better way of doing it than along the lines mentioned of having necessary notes ready for quick reference, in a book set aside for that special purpose.

Para. 3 CHANGES AND ALTERATIONS OF FACILITIES

When any facilities are to be renewed or repaired, it should be borne in mind that we are endeavoring to standardize as much as possible, and in many cases standard designs are available. If in doubt the Master Car Builder should be communicated with through the correct channels, and blue prints or other necessary information will be supplied where available.

SECTION XIV

TRAIN OPERATIONS

Para. 1 **NOTATION OF OVERLOADING AND WRONG LOADING**

Unless record and report is made of overloading and wrong loading, the situation is unlikely to be corrected. It is not enough to observe that a car is wrongly loaded, and send it to the repair track and have it righted. The matter must be followed up so that the initial loading point may have its attention drawn to the fact that the company was put to the expense of correcting their error, and in this way a reduction of the number of wrongly loaded cars can be obtained.

Such notation of wrong loading also serves the purpose of showing that inspectors are observant.

Para. 2 **RECORD OF CARS USED FOR INFERIOR LOADING**

One of the worst abuses we have to contend with is cars being used to haul loads which might have been placed in poorer class cars. For instance first class box cars particularly are used for conveyance of not only loads which could be hauled in second-class cars, but of loads which spoil the cars for use as flour or grain cars, account contamination, etc. A check against this condition often results in resentment being aroused, but in the interests of the railroad it must be pursued, as otherwise we will be unable to provide cars to handle grain during the grain loading season. In all cases a record should be kept of all cars observed being wrongly used as described, and upon request these figures can be obtained and consolidated, showing the extent of the wrong use of cars for the system as observed over a given period.

Para. 3 **WEAK EQUIPMENT IN HEAD-END SERVICE**

Despite our efforts to have weak cars switched to the rear of trains, the practice of allowing such cars to proceed in the middle or head end of long heavy trains will continue, unless pursued relentlessly. Section 6, Para. 9, quotes operating rule governing the handling of the class of equipment referred to, and all points should make a practice of noting abuse of this rule, so that from time to time campaigns can be conducted against it. The information can be kept in the same book as referred to in previous paragraph.

Making a record of it does not mean the matter is to be allowed to rest there. In all cases the attention of the operating department should be drawn to the matter, and in the case of passenger cars, action taken as laid down in Sub-Para. (xii), Para. 14 of Section 1, and notation made on 975 report.

Para. 4**ROUGH HANDLING OF CARS**

Newly built empty cars of the very strongest construction can be made bad order merely by switching. It is not possible to construct cars to withstand the greater shocks that can be developed in switching. Cars must, therefore, be intelligently handled, and in this connection it is the foremen and inspectors of the car department that are to be the watch dogs to observe that cars are not handled unduly roughly, as in many cases it has been found switchmen have only a very vague idea of what constitutes rough handling, and are unable to estimate the strains and shocks imposed by a car at four or five miles an hour hitting a string of loads.

Reports are to be made once a month of all cases of rough handling observed, and where damage results a photograph showing such damage should accompany the report. Reports will be sent through the correct channels to district headquarters, and district general car foremen will send consolidated report to M. C. B.

Copies of reports will in all cases be forwarded to the local official of the operating department.

Para. 5**TOOLS MISSING FROM CABOOSES,
COMBINATION CARS, ETC.**

Sleepers and coaches are to be inspected at regular periods, and any tools, etc., found short of their regulation equipment, will be replaced. In the case of cabooses and combination cars—especially those that operate from outlying points—however, it is found they are often in a very incomplete state. Apart from items missing, tools are often put out on the floor, and the lockers provided used to put clothes, etc., in. Cars operate in this condition until something occurs where the tools, brasses, hose, chains, or some other item is required, and then there is a complaint made. Foremen will, where combination car, or caboose in pool service, is found in the condition complained of, fix the car up standard, and report the matter to the local official of the operating department, one copy being sent to the district general car foreman and one copy to the Master Car Builder direct. The condition of the car or caboose should then be noted upon its return, and where found in other than proper order a complaint made to the operating department, as described, with copies to district general car foreman and Master Car Builder. It will then be the duty of the district general car foreman to follow the matter up, and unless satisfaction is obtained and a stop put to the practice complained of, the matter should be reported to the Master Car Builder, quoting correspondence previously referred to.

WRECKING REPORTS

Para. 1

CD 26 REPORT

This form has been specially drawn up so as to simplify reporting necessary information in connection with wrecks and accidents. Instructions printed on the forms read—"This report to be made by derrick-foreman promptly. One copy to be sent to division or terminal superintendent, one copy to assistant master car builder or district general car foreman, one copy to Master Car Builder, Milwaukee shops, one copy to round house foreman, who will complete information for his department and forward at once to division master mechanic."

Information is to be carefully and accurately given, otherwise correspondence will result. If space for remarks is insufficient a sheet of plain paper should be attached to report to carry additional information.

Para. 2

SPECIAL REPORTS

It will often be necessary to supply special reports in connection with wrecks, but these will always be additional to CD-26. No rule can be laid down, but wrecking foremen should note very carefully the instructions laid down in Section 7 covering wrecking, and should keep in their log book a note of every occurrence en route to, at, or in connection with a wreck or accident, as the information may be very important should special reports be called for.

WIRED REPORTS

Para. 3

As soon as inspection of a wreck has been made, the wrecking foreman will wire direct to the Master Car Builder and general car foreman (also assistant master car builder on Lines West) stating extent of wreck, giving numbers and initials of either system or foreign cars damaged and estimated cost of repairs, cause of derailment, estimated time it will take to clear wreck, and any other information likely to be of use or interest. Cars damaged beyond repair must be specially mentioned with request for disposition. (See also Section IX, para. 9, sub-para. (i).) In any cases where cars or equipment have been tipped over, burned or destroyed by operating officials prior to arrival of wrecker, details will be included briefly in wire.

OTHER REPORTS AND ADMINISTRATION

Para. 1 MAN HOURS WORKED, COST, AND DISTRIBUTION OF COST

Sub-Para. (I) CHECKING TIME WORKED

At each point on the system where car forces are employed, a system of checking men in and out at the starting time and at the end of the day's work, must be inaugurated and kept up. At the majority of points numbered boards are provided on which small brass checks are hung marked with numbers corresponding to those on the board. As each man is hired he is given a number and when he reports for work he will be handed the brass check bearing this number, which he will retain until the end of the day.

The name of each individual man should be marked on the board below his number and missing checks should be replaced without delay. Men who do not check in, such as inspectors who go direct to the yards or men sent to outside points, are to have a small cardboard disk placed on top of their brass checks on the board with a notation made upon it explaining why his check remains on the board. Where more than one shift is employed it is a good plan to divide the board or boards up by placing *at the back* of the brass check colored circular disks which will indicate the shift the man is working on. For instance, if three shifts were employed, those on the first shift would be indicated by a white disk hung at the back of the brass check; those on the second shift by a blue disk; and those on the third shift by a red disk.

When the men report for work they will be handed their checks, preferably by the foreman for whom they are working, and when the whistle blows the board should be locked after making a record in a special book (which should be kept for that purpose) of any men that are absent. Unless a late slip is turned in no time is to be allowed for such absent employes for that day. If an employee should report for work between 8:00 and 8:15 A. M. he will be required to wait until 8:15 before starting work, or if he reports for work between 8:15 and 8:30 he will be required to wait until 8:30 A. M. At points where only one shift is employed men will check out at lunch time and in again before starting work. In such cases a record of absent men will also be taken at lunch time. When the men check out at the end of the day they must be required to deposit their time slips at the same time that they hand in their brass checks, and in this connection much initiative can be displayed in the arrangement of checking boards and by the method of checking out whereby each man can drop his brass check through a slot into a box and at the same time deposit his time slip through a slot into a box placed immediately alongside of the former. Wherever possible checking boards should be placed inside the foreman's office or in a specially designated

building. Some excellent arrangements have been made at local points whereby foreman can pull back a sliding window in his office and hand the checks out to the men who pass by under an extended roof which protects them from the weather. When the men check out again they deposit their checks and time slips into boxes through slots provided in the ledge of the same window. The slot through which the brass checks are deposited is made so that only one check can be passed through it at a time.

At some of the shop points other satisfactory arrangements have been made whereby the men check in and obtain their checks and then when they report to their own particular foreman or gang leader they hang their checks up on designated hooks in such a way that the foreman or gang leader is able to tell at once whether any men are absent. This is a very good system where men are split into small groups working in shops, as it overcomes the difficulty of losing checks and answers the double purpose of telling the men they are to report to, just who is present and who is not. At some points a time clock system is in use and this requires no explanation other than to say that it is quite necessary that the clocks be placed in such a position that supervision can be kept over them. As long as abuses of the system are tolerated, such as one man checking in or out for another, the reason for which the clocks are provided is defeated, and as these clocks cost a considerable amount of money it is considered nothing less than the duty of the local foreman to see that they are properly and intelligently used. When men are sent out on the road or to transportation yards direct no one but the foreman personally should be permitted to punch the men's cards, and in addition to passing them through the clock the foreman should mark the cards in such a way that he can personally vouch for having allowed the men the time without them punching their own cards in the ordinary way.

Sub-Para (II)

LABOR COST

At the end of the day each man will be required to fill out a time slip and from these slips duly countersigned by the foreman, the timekeeper will enter each individual employes record of time worked on Form 310, which will be sent into the various branches of the accounting department as designated by local instructions. Timekeepers should see that they have a time slip (Form 106) or an absent slip (Form 683) for every day for every employee shown on their time books so that at pay periods there will be no dispute as to the amounts drawn.

Sub-Para. (III)

DISTRIBUTION OF LABOR

It is very necessary that we supply the information required in order that proper distribution may be made of all labor costs. So that there may be no misunderstanding of either the necessity for this nor of the method of making the distribution the following explanation is given, being an extract from a paper read and discussed at our 1920 staff meeting:

"The development of the U. S. A. and consequent railroad expansion, carried with it competition so keen as to always be a safeguard to the public in the matter of railroad service. With the end of broad general

expansion came a desire for public ownership or control, and the outbreak of the late war lent weight to this wish. After a period of Federal control roads have reverted to private ownership, but freight and passenger rates are fixed by the Interstate Commerce Commission, representing the U. S. Government.

These rates are arrived at after studying costs of maintenance and operation from figures supplied by the various railroads. In order that the Interstate Commerce Commission may know just what these figures represent, a system of bookkeeping has been drawn up for universal use by the railroads.

As freight and passenger rates are based on figures supplied by us, it will be seen how important it is that these figures be correct—on them our earning capacity is increased or decreased. To an extent it means the roads very life blood.

While the total amount of money earned and spent can be comparatively easily arrived at, the same cannot be said of obtaining the respective costs of individual operations, or phases of operations. For the most part the company has to rely entirely upon what is on the individual time slip, and this commencing point of railroad expenditure is the responsibility of foremen and assistant foremen. It need not be emphasized, therefore, of what great importance it is that foremen and assistant foremen should have a clear grasp of what is required of them in connection with accounting for expenditures, as all the human energy and driving force it is possible to muster and direct to the building up and perfecting of our equipment—would be more or less thrown away unless our figures were so kept that the road be granted rates to enable it to earn sufficient money to justify its existence.

The system of bookkeeping is divided into two parts—the first consisting of those accounts which earn money for the company—called revenue accounts—and those which spend money—called non-revenue or expense accounts. The first side of the system is divided into four main accounts and the non-revenue side into eight. The accounts are:

Revenue Accounts

1. Transportation (Rail Line).
2. Transportation (Water Line).
3. Incidental.
4. Joint Facility.

Expense Accounts

1. Maintenance of Way and Structures.
2. Maintenance of Equipment.
3. Traffic.
4. Transportation (Rail Line).
5. Transportation (Water Line).
6. Miscellaneous Operations.
7. General.
8. Transportation for Investment.

In the car department we are concerned only with the expense accounts side of the bookkeeping system, and then with (practically) only two of the eight accounts; they are *Maintenance of Equipment* and *Transportation*.

These two accounts like all other main accounts, are divided into a

number of sub-accounts, and it is very important that our expenditures be charged not merely to the right account, but to the correct *sub-account*. The sub-accounts are:

<i>Maintenance of Equipment</i>	<i>Transportation (Rail Line)</i>
301 Superintendence	371 Superintendence
302 Shop Machinery	372 Dispatching Trains
303 Shop Machinery—Depreciation	373 Station Employes
304 Power Plant Machinery	374 Weighing Inspection and De-
305 Power Plant Machinery De-	murrage Bureaus
preciation	375 Coal and Ore Wharves
306 Power Substation Apparatus	376 Station Supplies and Super-
307 Power Substation Apparatus	visors
Depreciation	377 Yardmasters and Yard Clerks
308 Steam Locomotives—Repairs	378 Yard Conductors and Brake-
309 Steam Locomotives—Deprecia-	men
tion	379 Yard Switch and Signal Tend-
310 Steam Locomotives—Retire-	ers
ments	380 Yard Enginemen
311 Other Locomotive Repairs	381 Yard Motormen
312 Other Locomotive Depreciation	382 Fuel for Yard Locomotives
313 Other Locomotive Retirements	383 Yard Switching Power Pro-
314 Freight Car Repairs	duced
315 Freight Car Depreciation	384 Yard Switching Power Pur-
316 Freight Car Retirements	chased
317 Passenger Car Repairs	385 Water for Yard Locomotives
318 Passenger Car Depreciation	386 Lubricant for Yard Locomo-
319 Passenger Car Retirements	tives
320 Motor Equipment of Cars Re-	387 Other Supplies Yard Locomo-
pairs	tives
321 Motor Equipment of Cars De-	388 Enginehouse Expenses, Yard
preciation	389 Yard Supplies and Expenses
322 Motor Equipment of Cars Re-	390 Operating Joint Yards and
tirements	Terminals, Cr.
323—Floating Equipment, Repairs	391 Operating Joint Yards and
324 Floating Equipment, Depreci-	Terminals, Dr.
ation	392 Train Enginemen
325 Floating Equipment, Retire-	393 Train Motormen
ments	394 Fuel for Train Locomotives
326 Work Equipment, Repairs	395 Train Power Produced
327 Work Equipment, Depreciation	396 Train Power Purchased
328 Work Equipment, Retirements	397 Water for Train Locomotives
329 Miscellaneous Equipment, Re-	398 Lubricants for Train Locomo-
pairs	tives
330 Miscellaneous Equipment, De-	399 Other Supplies, Train Loco-
preciation	motives
331 Miscellaneous Equipment, Re-	400 Enginehouse Expenses, Train
tirements	401 Trainmen
332 Injuries to Persons	402 Train Supplies and Expenses
333 Insurance	403 Operating Sleeping Cars

334	Stationery and Printing	404	Signal and Interlocker Operation
335	Other Expenses		
336	Maintaining Joint Equipment at Terminals, Dr.	405	Crossing Protection
		406	Drawbridge Operation
337	Maintaining Joint Equipment at Terminals, Cr.	407	Telegraph and Telephone Operation
		408	Operating Floating Equipment
		409	Express Service
		410	Stationery and Printing
		411	Other Expenses
		412	Operating Joint Tracks and Facilities, Dr.
		413	Operating Joint Tracks and Facilities, Cr.
		414	Insurance
		415	Clearing Wrecks
		416	Damage to Property
		417	Damage to Livestock On Right of Way
		418	Loss and Damage, Freight
		419	Loss and Damage, Baggage
		420	Injuries to Persons."

Each point should be in possession of a copy of the I. C. C. book "Classification of Operating Revenues and Operating Expenses of Steam Roads," and also a copy of the index to same. The former gives full details of the items to be charged to each of the accounts enumerated herein and in using these books decision as to what account any work should be charged to should not be made by reference to the index but invariably by reference to the book itself.

In addition to the accounts already enumerated we are occasionally called upon to do work chargeable to "*Maintenance of Ways and Structures*" such as Account 235, Repairs to Shops, Buildings, etc., in connection with which the particular building must invariably be specified; or Account 233, Repairs to Coal Chutes; or Account 271, Repairs to Small Tools and Supplies for Repair and Track use. These three accounts are all sub-accounts of "*Maintenance of Ways and Structures*."

The only distribution not covered by these instructions is A. F. E. work. When an A. F. E. is issued to cover certain work it means that it is to be paid for out of Capital Account, and therefore instead of charging labor expended in connection with it in accordance with the account numbers outlined above it will be charged to the A. F. E. number or shop order number issued locally for convenience. In other words, whenever an A. F. E. or shop order number is given all labor in connection therewith must be charged to such numbers, otherwise in all cases to the account numbers as prescribed by the I. C. C., and enumerated above.

The work which a man is employed upon is to be stated on his time slip, and when countersigning same the foreman will mark on it the account number to which it is chargeable, or where properly trained time

clerks are available the account numbers may be put on by them. However, it must be borne in mind that it is primarily the responsibility of the foreman to see that men fill in time slips stating correctly the work they were engaged upon, and that the proper account number for such work is ultimately placed upon the time slip, as unless this is done it will be impossible to obtain the cost of many operations of the railroad, which, while amounting to a great deal of money in the aggregate is made up entirely of small costs incurred at a large number of points.

Para. 2 CHECK OF PAYROLL EXPENDITURE

Sub-Para. (I) ALLOTMENT OF MONEY

Each month the car department is allotted a certain amount of money to expend upon its operations. This amount is divided between the different car points over the system in accordance with conditions existing at the time the distribution is made. It is not always possible nor practical for points to keep accurately to the amount allotted, nor is it desired that operations be hampered by endeavoring to work within their allotment, but it is necessary that the car department collectively keep within the total amount apportioned to them. Normally the small over-run of some points will be counterbalanced by the amount under-expended by other points, but in order to keep a check on this matter a system has been evolved as set out herein.

Sub-Para. (II) PAYROLL STATEMENT

So that each point may keep a check of its expenditure a payroll statement pro forma has been drawn up and put into use, giving the following information to be recorded daily:

Straight						Author.		Unauthor.	
Time		Overtime		Total	Total	Overtime		Overtime	
Hrs.	Amt.	Hrs.	Amt.	Time	Amt.	Hrs.	Amt.	Hrs.	Amt.
A	B	C	D	E	F	G	H	J	K

After the seventh, fifteenth, twenty-third and last day of each month, the figures thus kept will be totaled up for the past week, and 25 per cent of the salary of monthly rated employes added, and the total wired to the Master Car Builder, under the symbols given, to enable his office to check the rate of expenditure against the total allotment for the car department. It must be ascertained by each foreman that the amounts thus reported during the month correspond with the actual payroll for the same period. Unless the payroll statement corresponds with the actual payroll the collective check will not be reliable and as a result the department will be apt to exceed its allotment and cause embarrassment.

Para. 3 676 REPORT

On the last working day of each month a check of all bad order cars on hand at local point and stored at nearby stations which are considered as the local foreman's territory, must be made, and report made on form 676 direct to the Master Car Builder. Copies of this report will be made and furnished in accordance with local instructions.

It is important that this report be made out carefully and correctly, as much data is obtained from it—both by the mechanical and operating departments. The total number of cars held must correspond with the figures shown on No. 55 report for same day.

Cars held for schedule work need show no other information than the schedule number, and where practicable listed separately. Principal defects should be given in other instances. Date car is expected to be ready for service need not be shown when it will be more than four weeks in advance of the time report is made up. Care should be taken that automobile, furniture and box cars are not confused;—if a car is an automobile it should be shown as such—not as a box. In the same way a furniture car should be correctly named.

The 5th of each month is positively the last day on which this report is to reach the M. C. B. office, as much information has to be worked up from it and submitted to those concerned *before* the 10th. There is no objection, at points where many cars are held and it be known that same will not be disturbed for several days, to commencing the check several days prior to the end of the month. Report may be closed as of morning of last working day of month.

Para. 4

NO. 55 REPORT

This report is to be furnished by all points on the system, where carmen are employed, for each working day. It will show by kinds the cars repaired for the day and cars on hand; also class of repairs needed to cars on hand. The report will be made out as early in the day as possible, and filed with local telegraph office for dispatch by wire in all cases other than points where it can be forwarded by mail so as to reach Milwaukee next morning.

This report must also account for all bad order cars, including those which may be stored at nearby stations. Local foremen must know that the foreman at next repair point has not already taken into account such stored cars. In other words, a local understanding must be had as to who will report cars in bad order at storage places.

Para. 5

REPORTS OF COMPANY PROPERTY DESTROYED

All of the company's property, structures, equipment and merchandise in transit is covered by insurance either with outside companies or with the Corporate Insurance Fund. Whenever any extensive damage occurs to property (this includes foreign cars) wired report will be made without delay to the Master Car Builder and to the superintendent of the division on which the damage occurs. Following this wired report Form 85 must be filled out and two copies forwarded direct to the master car builder.

Report must be made on Form 84 for all losses sustained by fire in excess of \$1.00 per car, with the exception of cinder dump cars, which will not be reported on account of damage done by hot cinders unless it amounts to \$10.00 or more per car.

**Para. 6 ACCOUNTING FOR SALVAGE RECOVERED
FROM CARS DISMANTLED**

It is important that all salvage recovered from cars dismantled be properly valued and credit obtained. In order that this may be done the following procedure is to be carefully followed by all concerned:

(a) A statement showing the material salvageable from each type of car, provided there are no parts missing, is obtainable from the Master Car Builder upon application.

(b) Before a car is dismantled or taken down a joint inspection will be made in each case by the car foreman and the district or division storekeeper to determine the parts missing.

(c) The amount of scrap and second-hand material recovered shall be reported in quadruplicate by the car foreman on Form CD-12, which will be arrived at by deducting the missing parts, as determined by the above joint inspection, from the amount of material salvageable shown on the statement furnished by the Master Car Builder.

(d) Form CD-12 as made out will be priced, classified, and attested to by the district or division storekeeper.

(e) After the car has been dismantled or destroyed the car foreman will mail two copies of Form CD-12 to the Master Car Builder and one copy to the district or division storekeeper, retaining the fourth copy on file.

(f) The duplicate copy of Form CD-12 will be used instead of Form 1728 in reporting scrap or second-hand material recovered from cars dismantled or destroyed.

(g) When statement of equipment retired from service (Form 533) is made out in the master car builder's office, the salvage shown thereon will agree with the amount shown by the car foreman on Form CD-12.

**Para. 7 CARS RECEIVED ON REPAIR TRACKS,
RETURNED TO SERVICE, OR
REMAINING ON HAND**

In order that the car accountant may be enabled to trace the movement of any car, make bills for system cars on foreign roads, and pass for payment bills rendered against us for foreign cars on our road, it is necessary that information concerning the movements of all cars should be supplied him.

The machinery for supplying this information is provided mainly by other departments, but certain car department points, in accordance with current lists, are called upon to make out Forms 112 revised and 284.

Form 112 is supplied in a large form (9"x13") and a perforated form, the latter being an exact duplicate of the former with the exception only

of the additional column showing the cars remaining on hand. The car accountant, Chicago, is to be provided with one copy of both forms, the Master Car Builder with one copy of the large form and a copy of the large form should also be kept on file. Report is to be made out daily except Sundays and holidays, and is to be numbered consecutively starting from 1, beginning on the first day of each month. If a station issued five sheets on the first day of the month they would be numbered 1, 2, 3, 4 and 5, and if on the next day the same station issued three sheets, they would be numbered 6, 7 and 8. This report must include all cars (foreign and system) that are destroyed, changed, held for material or other disposition, new cars built, received for repairs, placed on the road, and cars remaining on hand. Great care must be exercised in providing not only all the information called for but in giving it correctly.

Form 284 is to be made out on the last day of each month in duplicate, the original being forwarded to the car accountant at Chicago and duplicate filed. This report will show the numbers, initials, whether loaded or empty, station, number and date of receipt of cars on hand the last day of each month.

Para. 8 CHANGES OF EQUIPMENT REPORT

Instead of making separate reports for the various minor changes of equipment, on the 25th of each month a report will be made out by each point on the system (nil report where information blank) and forwarded direct to the M. C. B. office. The report is to cover the items shown below but *is not to include schedule work*. The pro forma for the report will be:

Changes of Equipment Report

Car No.	Date	Change, Alteration Removal or Addition.	Number, initial or item on car previous to change.
		Report of system cars equipped with Type D couplers.	
		Report of express cars equipped with label holders.	
		Solid ends applied to auto cars.	
		End gates changed on Hart Convertible cars.	
		C. M. & P. S. initials changed to C. M. & St. P.	
		S. I. initials changed to C. T. H. & S. E.	
		C. S. initials changed to C. T. H. & S. E.	
		Cars equipped with metal brake beams.	
		Roof changes.	
		Ends slatted up on Stock Cars.	
		Cars equipped with Friction Draft Gears.	
		Cars equipped with Wine Door Hooks.	
		Cars—dump doors made inoperative.	
		Stock cars—hay racks removed.	
		Stock cars—water troughs removed.	
		End gates applied or removed—Gondola or Ballast cars.	
		Report of cars equipped with Safety Appliances.	
		Wine door fastenings applied to gondola cars.	
		T. E. equipment initials changed to C. M. & St. P.	

B. & N. equipment initials changed to C. M. & St. P.
P. S. & W. H. equipment initials changed to C. M. & St. P.
S. P. A. & W. equipment initials changed to C. M. & St. P.
G. V. equipment initials changed to C. M. & St. P.
(Number changes also to be shown on form 112 report.)

Para. 9**PRESERVATION OF RECORDS**

Records must be properly preserved, but if it is necessary to dispose of any for which adequate space is not provided authority must be procured from the Master Car Builder before anything is destroyed.

In this connection the following circular issued by Director General Payne is published for guidance:

“All accounts, records and memoranda including all documents, papers and correspondence by the carriers which were under Federal operation during Federal control are Government records placed in the custody of the carriers by the President under Transportation Act, 1920, and are subject to the statutes relating to the destruction of such records. This is to advise that before any records kept during the period of Federal control are destroyed, the question of the destruction of such records should be taken up with the Comptroller of the United States Railroad Administration and his prior consent obtained, even though under the regulations of the Interstate Commerce Commission it may be permissible to destroy such records.”

GENERAL SUMMARY

The opening section of this book gives a brief outline of our organization. The eight following sections—numbered 1 to 8 inclusive—describe our operations.

Operations *Inspection* covers fully all phases of inspection of car equipment during operation and repair. This section embraces four paragraphs covering Safety Appliances, Wheels, Axles and Brakes which are complete in themselves—that is to say, they have been written for more than the inspector, but are placed in the section in question (Inspection) for convenience.

Repairs covers the methods to be adopted in handling both our own and foreign freight cars, as well as system passenger train cars, tenders, cabs and pilots. The section must, of course, be read in conjunction with the paragraphs under “Inspection” on Safety Appliances, Wheels, Axles and Brakes, and also with Section 4—Standard Practices.

Materials deal with the items necessary to carry out the work of inspecting and repairing.

Standard Practices is also a very important section, laying down standard methods of handling work, arrived at as the result of much study and experience.

Standard Facilities points out the advantage of standardization of our tools and shop facilities, and enumerates items which it has been possible to make uniform.

Train Operations provides information in respect to the meeting point between the Mechanical Department and the Operating Department.

Wrecking is a section describing what it is necessary to provide for our wrecking outfits, how they should be maintained and handled, and giving general rules for the picking up of wrecks. Particular attention must be given to the part of these instructions dealing with safety factors in the lifting of derailed equipment.

General Information is self explanatory.

Administration In the second part of the book there are eight sections—corresponding somewhat to the eight sections in the first part—which describe the reports, records, etc., it is necessary to maintain in the administration of the Car Department. Unless constant watch is kept upon the situation the number of reports required will grow unnecessarily. Factors beyond our control compel our rendering many reports, while others are necessary for our own use in administration. The total arrived at from these two sources is such as to make heavy demands upon the time of local foremen, and general foremen and district general foremen must refrain from calling for additional reports or records for their own use, unless circumstances thoroughly warrant such action.

Conclusion

It is hoped this book will be utilized to the best possible advantage. It represents the experience of many over a long period, and much of the information is based on careful experimentation and research. Only by turning to proper account the knowledge contained herein can the compilation and publication of the book be justified. The methods and procedure outlined are dependent for success upon intelligent application.

In concluding the writing of this book it is realized that Energy and Pride of Service are factors essential to success in handling the great problems that lie before us. It is to the foreman—the employe—to provide the energy which must be expended along the lines already defined. Pride of Service will arise automatically from a study of the history and workings of our great railroad.



“These trains must be kept efficient to maintain their reputation, and eternal vigilance is the price of efficiency.”

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